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VOLUME XXXIII, PART IV

ANTHROPOMETRY AND BLOOD TYPES IN FIJI AND THE SOLOMON ISLANDS

Based upon Data of Dr. William L. Moss

By William W. Howells

By Order of the Trustees
of
THE AMERICAN MUSEUM OF NATURAL HISTORY
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INTRODUCTION

The material here presented was collected by Doctor William L. Moss, who was a member of the Crane Pacific Expedition of 1929 aboard the yacht "Illyria." It is through his generosity, as well as through the kind offices of Professor E. A. Hooton of Harvard University, that I have been permitted to study it and arrange it for publication. I am further indebted to Doctor Hooton for advice and help; the work of calculating and sorting was done at the Peabody Museum by his statistical staff. Needless to say I am also beholden to the American Museum for publication in the present form.

Doctor Moss is well known for his work in blood agglutination groups, and for his classification of them. His labors have provided an excellent series from Melanesia of which we have not only the blood types, but a number of important anthropological measurements and observations as well. Such series have heretofore been rare; consequently, work upon the association between blood groups and anthropological characters has been limited in quantity and scope. The material has the further virtue of coming from areas which are immunologically unknown and where no precise work has been done in somatology. Doctor Moss is therefore much to be thanked for having filled in these gaps.

From Fiji we have a group of 133 men, eighteen years old or more. This was obtained from among the students at a Methodist Mission school at Davuileva on the Rewa River in Viti Levu, and comes mainly from the interior of this island. There is also a small female sample, numbering 13.

The series of 85 from the Solomon Islands was measured at Tulagi and is preponderantly from Malaita and Guadalcanar, with a handful scattered among the other islands. Thus it is representative more exactly of the eastern end of the group than of the archipelago at large.

A third series of 51 examined at Rabaul, New Britain, is composed of natives from all along the coast of the Mandated Territory of New Guinea and up the Sepik River. This is a large area to cover in a small sample, particularly as the results of other workers show that there is considerable divergence among the peoples resident here; it would therefore be indiscreet to make any extended interpretations from so generalized a group. There is already a large number of series in the literature from various parts of the region, though little has been done to bring them together in perspective.

It is the first two series, then, that attract our attention. From the Solomons there are no satisfactory anthropometric data, and from

Fiji there are none at all. Excepting a few colonies of Polynesian speech, the Solomons Islanders have always been considered as orthodox representatives of the "Melanesian" peoples. With certain reservations, this is also true of Fiji. Though it possesses a number of Polynesian words and modifications, the Fijian language is truly Melanesian; Codrington called it "no more Polynesian than the languages of the Banks Islands." In the culture, though this too is fundamentally Melanesian, the debt to Polynesia is more pronounced. However, the Fijians have always been simply classed as Melanesians; so much so that Churchill apparently considered himself daring when he wrote:—

> Ethnically and philologically Viti must be acknowledged to lie in a position of mixture of the two neighbor stocks. I know that I go beyond many, if not all, of my fellow workers in weighing the Polynesian element in Viti.[1]

It is of course known that immigrants from Tonga have strongly affected the population of certain of the eastern islands, particularly the Lau group, and that this influence has been least in Viti Levu, where the inhabitants have been called the most "Negroid" or "Melanesian" of Fiji. It is this immigration from Tonga which has been believed mainly responsible for the Polynesian contributions to Fiji as a whole. Therefore our sample, coming from the interior of Viti Levu, should represent the most truly Fijian stock, and when the measurements on these men, if not the observations, show them to be rather more Polynesian than Melanesian in their affinities, the fact has a very different significance than if the sample had been drawn from the Lau Islands, in which case infiltration from Tonga could readily be taken as the explanation.

For comparative material there have been assembled practically all the available data on living peoples of Melanesia and Polynesia as well as a number of series from the north coast of New Guinea and the Bismarck Archipelago. The following list gives the approximate number in each series, with the author.

[1]Churchill, 2.

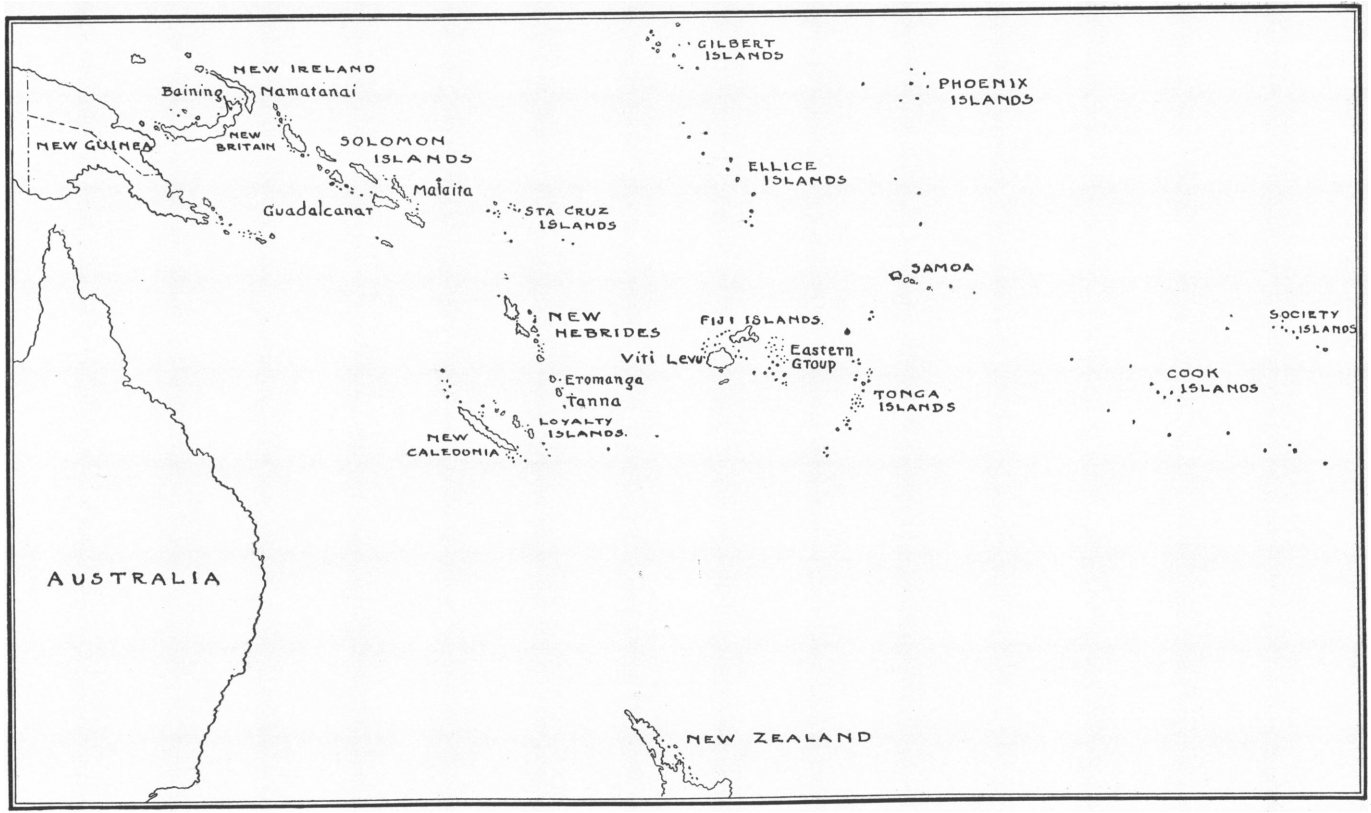

Fig. 1. Map showing Geographical Position of Groups Compared.

	Number	Author
Polynesia		
Tonga[1]	117	Sullivan, 1922
Samoa[1]	69	Sullivan, 1921
Society Islands	85	Shapiro
Hawaii	206	Wissler, 1927
Marquesas	84	Sullivan, 1923
Maori[1]	424	Buck
Melanesia		
New Hebrides		
Tanna[1]	187	Humphreys
Eromanga[1]	59	Humphreys
Santa Cruz	34	Speiser, 1923
Loyalty Islands[1]	86	Sarasin
New Caledonia	185	Sarasin
Namatanai[1] (Central New Ireland)	26	Friederici
Baining[1] (Northern New Britain)	78	Friederici
Aua Islands[1]	30	Chinnery
New Guinea		
Sepik River[1]	44	Chinnery
Jakumul	100	Schlaginhaufen
Arup	20	Schlaginhaufen
Leitere	21	Schlaginhaufen
Torricelli Mts.	30	Schlaginhaufen
Potsdamhafen	36	Bondy-Horowitz
Cape Nelson	90	Bondy-Horowitz
Kai	57	Bondy-Horowitz
Central New Guinea	27	Wirz

Tanna and Eromanga, southernmost of the New Hebrides, are strongly infused with Polynesian blood (Humphreys) so that the inhabitants do not resemble those of the northern part of the group. This is particularly true of Tanna, where Speiser (1912) says that the culture is "*fast rein Polynesisch.*" Therefore these series will not be used as representing Melanesians, but are included for comparison with the Fijians as being another Melanesian-Polynesian mixture. There is also Polynesian influence and blood in the Loyalty Islands, especially Uvea and Lifou.

In New Guinea a distinction should be made between coastal and inland groups. All the comparative material comes from the formerly German possessions in New Guinea. Leitere, Arup, and Jakumul are coast villages ten or twenty miles apart in the vicinity of Aitape, in the west, near the boundary of Dutch New Guinea. Potsdamhafen is some miles east of the mouth of the Ramu River, and Cape Nelson is far down near the eastern tip of the island. The Sepik River series should be

[1]Constants calculated by the author.

classed with the coastal groups. The remainder are inland peoples. The Torricelli Mountain villages are a few miles in from Aitape, and the Kai people inhabit the interior of the peninsula due north of the mouth of the Markham River. These are close to the sea, however, compared to Wirz's Central New Guinea group, which is found across the Dutch boundary, in the region of the headwaters of the Mamberamo.

For Fiji and the Solomons, the blood groups have been separated, and the means and constants of three of these are listed along with the total groups. The AB group in both series was too small to seriate. To avoid confusion I have designated the other groups as A, B, and O, which correspond to II, III, and IV, respectively, in Doctor Moss's classification, and to II, III, and I in Jansky's.

MEASUREMENTS AND INDICES

Stature

It is apparent that the peoples listed above can be divided into two groups on the basis of tallness, differing roughly by 10 cm. The Polynesians cluster about a mean of 170 cm. and the Fijians with them, in the center of the group. For other Melanesians, 160 cm. and less is the mode. The Loyalty Islands, New Caledonia, and the southern New Hebrides are exceptions; all of these, excepting New Caledonia, have Polynesian blood. The shortest people of all are the inhabitants of inland New Guinea.

Sitting Height

The Fijians have definitely shorter trunks than the Polynesians. The Maori, in spite of being the least tall of the Polynesians, have longer trunks than natives of the Societies. The Solomon Islanders have slightly longer bodies than the natives of New Guinea.

Relative Sitting Height

The sitting height expressed as a percentage of the stature shows the Fijians to be relatively longer-legged than either of the Polynesian groups or the Solomonese, though a still lower mean is found for New Guinea. This type of body proportion, long legs as compared with the trunk, is characteristic of negroid peoples: native Australians and some African groups having indices of less than 50, or legs which are longer than their trunks.

TABLE 1

STATURE

	No.	Range	Mean	σ	V
Fiji Islands					
Males	133	158–190	170.85±0.36	6.12±0.25	3.58±0.15
Blood Group A	57	161–184	170.37±0.53	5.94±0.38	3.49±0.22
Blood Group B	13	158–187	171.45±1.24	6.63±0.85	3.87±0.49
Blood Group O	59	158–190	171.00±0.55	6.27±0.39	3.61±0.22
Females	13	152–169	158.76±0.86	4.62±0.61	2.81±0.38
Solomon Islands					
Males	85	146–181	160.20±0.50	6.81±0.35	4.25±0.22
Blood Group A	29	146–175	159.51±0.82	6.51±0.58	4.08±0.36
Blood Group B	12	152–172	161.01±1.07	5.52±0.76	3.43±0.47
Blood Group O	42	146–181	160.92±0.73	7.05±0.52	4.38±0.32
New Guinea					
Males	51	143–181	159.00±0.61	6.50±0.43	4.09±0.27
Comparative Data					
Polynesia					
Tonga			173.04±0.36	5.17±0.26	2.99±0.15
Samoa			171.74±0.34	5.24±0.30	3.05±0.18
Society Islands			171.35±0.43	5.91±0.31	3.45±0.18
Hawaii			169.51±0.42	6.03	3.6
Marquesas			170.3		
Maori			169.77±0.18	5.66±0.13	3.34±0.08
Melanesia					
New Hebrides					
Tanna			164.52±0.30	6.06±0.21	3.68±0.13
Eromanga			166.00±0.47	4.80±0.33	2.89±0.20
Santa Cruz			160.3		
Loyalty Islands			167.49±0.34	4.70±0.24	2.81±0.14
New Caledonia			166.4		
Namatanai			161.85±0.68	5.13±0.48	3.17±0.30
Baining			159.10±0.47	6.18±0.33	3.88±0.21
Aua Islands			157.14±0.68	5.46±0.48	3.61±0.32
New Guinea					
Sepik River			164.42±0.67	4.31±0.47	2.65±0.29
Jakumul			158.2 ±0.40	5.92±0.28	3.74±0.18
Arup			160.0 ±0.71	4.71±0.50	2.94±0.31
Leitere			158.4 ±0.98	6.63±0.69	4.18±0.44
Torricelli Mts.			151.9 ±0.82	6.65±0.58	4.38±0.38
Potsdamhafen			161.8		
Cape Nelson			159.7		
Kai			151.1		
Central New Guinea			155.7		

TABLE 2

SITTING HEIGHT

	No.	Range	Mean	σ	V
Fiji Islands					
Males	132	78–101	88.33±0.18	3.06±0.13	3.46±0.14
Blood Group A	57	81– 95	88.36±0.21	2.31±0.15	2.61±0.16
Blood Group B	12	84– 95	88.75±0.59	3.03±0.42	3.41±0.47
Blood Group O	59	78–101	88.21±0.32	3.66±0.23	4.15±0.26
Females	13	75– 89	82.69±0.50	2.67±0.35	3.23±0.43
Solomon Islands					
Males	85	69– 95	83.59±0.28	3.78±0.20	4.52±0.23
Blood Group A	29	75– 89	83.44±0.43	3.42±0.30	4.10±0.36
Blood Group B	12	78– 89	84.01±0.60	3.09±0.43	3.68±0.51
Blood Group O	42	69– 92	83.92±0.40	3.87±0.28	4.61±0.34
New Guinea					
Males	51	75– 92	81.41±0.28	2.97±0.20	3.65±0.24
Comparative Data					
Polynesia					
Society Islands			89.40±0.25	3.43±0.18	3.84±0.20
Maori			90.98±0.10	2.79±0.08	3.07±0.09

TABLE 3

RELATIVE SITTING HEIGHT

	No.	Range	Mean	σ	V
Fiji Islands					
Males	132	46–57	51.73±0.08	1.36±0.06	2.63±0.11
Blood Group A	57	48–55	51.90±0.11	1.24±0.08	2.3 ±0.15
Blood Group B	12	50–55	51.66±0.24	1.26±0.17	2. .0.34
Blood Group O	59	46–57	51.58±0.13	1.50±0.09	2. .18
Females	13	50–55	52.34±0.17	0.94±0.12	1. .24
Solomon Islands					
Males	85	46–57	52.12±0.12	1.64±0.08	2.92±0.15
Blood Group A	29	48–55	52.36±0.21	1.66±0.15	3.17±0.28
Blood Group B	12	50–55	52.00±0.23	1.20±0.17	2.31±0.32
Blood Group O	42	46–51	52.08±0.18	1.74±0.13	3.34±0.25
New Guinea					
Males	51	48–57	51.12±0.15	1.55±0.10	3.03±0.20
Comparative Data					
Polynesia					
Society Islands			52.18±0.12	1.58±0.08	3.03±0.16
Maori			53.44±0.04	1.31±0.03	2.45±0.06

HEAD LENGTH

Heads of fairly high absolute length prevail in Polynesia, particularly among the Maori; the means of Fiji, the Solomons, and the Society Islands are a trifle lower. The Southern New Hebrides give a mean of much the same size as the above groups and the Loyalty Islands a considerably higher one. The figures in western Melanesia are a little lower, being highest on the coast of New Guinea and lowest, for those cited, among the Baining of New Britain.

HEAD BREADTH

In Polynesia the head breadth stands in inverse ratio to the length, though all groups are broad-headed in an absolute sense. Of those listed, the Maori are narrowest and the Society Islanders broadest. As the Fijians are slightly less than the Samoans and Tongans in length, so are they in breadth, though the difference in both cases is slight. The Tannese of the New Hebrides are not far from these two groups, though longer and narrower of head than the Fijians.

For the rest of Melanesia, the width is greatest for the short-headed Baining and the district of Namatanai in New Ireland. On the coast of New Guinea the mean ranges between 140 and 146 millimeters, or less, on the whole, than Melanesia generally.

Taking the length and breadth of the head together and neglecting the height, a few remarks may be made on its absolute size. Absolutely large heads are the rule of Polynesia and the Loyalty Islands, while the size for Fiji and the Southern New Hebrides is slightly less. As in Polynesia, there is a rough inverse ratio between the length and breadth of head in Melanesia, the absolute size being distinctly less, although the Solomons come a trifle closer to the groups named above than the rest.

TABLE 4

HEAD LENGTH

	No.	Range	Mean	σ	V
Fiji Islands					
Males	133	164–208	188.82±0.43	7.29±0.30	3.86±0.16
Blood Group A	57	164–211	189.36±0.69	7.71±0.49	4.07±0.26
Blood Group B	13	179–205	190.14±1.27	6.81±0.87	3.58±0.46
Blood Group O	59	176–208	187.92±0.61	6.93±0.43	3.69±0.23
Females	13	170–190	178.62±1.09	5.85±0.77	3.28±0.43
Solomon Islands					
Males	85	170–208	188.46±0.48	6.51±0.34	3.45±0.18
Blood Group A	29	179–202	188.70±0.72	5.76±0.51	3.05±0.27
Blood Group B	12	176–199	187.50±0.97	4.98±0.69	2.66±0.37
Blood Group O	42	170–208	188.64±0.77	7.41±0.55	3.93±0.29
New Guinea					
Males	51	170–199	184.95±0.48	5.06±0.34	2.74±0.18
Comparative Data					
Polynesia					
Tonga			190.84±0.41	6.60±0.29	3.46±0.15
Samoa			190.71±0.47	5.72±0.33	3.00±0.17
Society Islands			188.01±0.48	6.54±0.34	3.48±0.18
Hawaii			187.85±0.47	6.78	3.6
Marquesas			193.2		
Maori			196.54±0.19	5.71±0.13	2.91±0.07
Melanesia					
New Hebrides					
Tanna			191.22±0.34	6.84±0.24	3.58±0.12
Eromanga			191.55±0.56	6.39±0.40	3.34±0.21
Santa Cruz			188		
Loyalty Islands			199.62±0.39	5.31±0.27	2.66±0.14
New Caledonia			192.5		
Namatanai			183.81±0.82	6.20±0.58	3.37±0.32
Baining			177.78±0.41	5.33±0.29	3.00±0.16
Aua Islands			184.33±0.76	6.17±0.54	3.35±0.29
New Guinea					
Sepik River			188.43±0.61	5.96±0.43	3.16±0.23
Jakumul			190.7 ±0.34	5.06±0.24	2.66±0.13
Arup			186.5 ±1.04	6.89±0.73	3.69±0.39
Leitere			187.1 ±0.98	6.69±0.70	3.57±0.37
Torricelli Mts.			183.5 ±0.78	6.35±0.55	3.46±0.30
Potsdamhafen			181.0		
Cape Nelson			185.2		
Kai			181.1		
Central New Guinea			190		

TABLE 5

HEAD BREADTH

	No.	Range	Mean	σ	V
Fiji Islands					
Males	133	135–170	153.67±0.35	6.06±0.25	3.94±0.16
Blood Group A	57	135–170	153.88±0.59	6.63±0.42	4.31±0.27
Blood Group B	13	144–167	154.00±1.01	5.40±0.69	3.51±0.45
Blood Group O	59	141–170	153.40±0.49	5.61±0.35	3.66±0.23
Females	13	144–161	149.62±0.87	4.65±0.62	3.11±0.41
Solomon Islands					
Males	85	126–158	144.73±0.38	5.16±0.27	3.57±0.18
Blood Group A	29	132–152	144.70±0.51	4.11±0.36	2.84±0.25
Blood Group B	12	126–155	144.49±1.38	7.11±0.98	4.92±0.68
Blood Group O	42	132–158	145.15±0.51	4.89±0.36	3.37±0.25
New Guinea					
Males	50	129–152	141.83±0.42	4.37±0.29	3.08±0.21
Comparative Data					
Polynesia					
Tonga			154.84±0.27	4.27±0.19	2.76±0.12
Samoa			154.81±0.36	4.47±0.26	2.89±0.17
Society Islands			159.58±0.36	4.96±0.26	3.11±0.16
Hawaii			157.67±0.38	5.50	3.4
Marquesas			153.2		
Maori			152.89±0.14	4.39±0.10	2.87±0.07
Melanesia					
New Hebrides					
Tanna			150.73±0.28	5.61±0.20	3.72±0.13
Eromanga			144.34±0.46	5.22±0.32	3.62±0.22
Santa Cruz			144.		
Loyalty Islands			144.56±0.35	4.81±0.25	3.33±0.17
New Caledonia			147.		
Namatanai			147.27±0.66	4.96±0.46	3.37±0.32
Baining			148.64±0.36	4.74±0.26	3.19±0.17
Aua Islands			145.07±0.48	3.92±0.34	2.70±0.23
New Guinea					
Sepik River			141.27±0.44	4.37±0.31	3.09±0.22
Jakumul			141.2 ±0.33	4.83±0.23	3.42±0.16
Arup			143.7 ±0.56	3.73±0.40	2.60±0.28
Leitere			146.0 ±0.62	4.20±0.44	2.87±0.30
Torricelli Mts.			142.5 ±0.47	3.81±0.33	2.68±0.23
Potsdamhafen			145.1		
Cape Nelson			140.0		
Kai			142.6		
Central New Guinea			147.		

Cephalic Index

With the exception of the Maori, the Polynesians are nearly or actually brachycephalic, and the Fijians likewise stand on the border-line between mesocephaly and brachycephaly. Elsewhere in Melanesia the cephalic index is dolichocephalic or low mesocephalic, with little consistency in its distribution: exceptions to this are Namatanai, New Ireland, Potsdamhafen in New Guinea, and the Baining of New Britain, the latter being brachycephalic. Notable for dolichocephaly are the Loyalty Islands. This is due of course to the inexplicably great head length of this group. Although the Polynesians are slightly longer of head than the Melanesians, the cephalic index of the former is higher because of their considerably greater head breadth.

Bizygomatic Diameter

Here, in regard to the absolute width of the face, is to be found a demarcation between Polynesia and Melanesia. The difference is not great, the eastern Melanesians being close to the Polynesians, though above New Guinea and the Bismarck Archipelago. Fiji is found among the eastern groups, surpassing the Marquesas and Tonga. Of the southern New Hebrides, Tanna does likewise, though Eromanga is lower. The facial width of the Solomonese is rather less than the general average for their neighbors southward, though much like that of New Guinea.

Cephalo-Facial Index

This expresses the relation of the breadth of the face to the breadth of the head. The index is fairly low for Polynesia and Fiji, although variable, and is higher in some parts of Melanesia; thus, although the faces of Polynesians are broader than those of the latter, their heads are still more broad.

In Melanesia, the absolute measurements show that high indices are an expression, not of broad faces, but of narrow heads. The low indices of Namatanai and the Baining thus agree with their brachycephaly; that of the denizens of the Torricelli Mountains is due to their particularly narrow faces.

TABLE 6

CEPHALIC INDEX

	No.	Range	Mean	σ	V
Fiji Islands					
Males	133	68–94	81.54±0.27	4.68±0.19	5.74±0.24
Blood Group A	57	68–94	81.57±0.46	5.16±0.33	6.33±0.40
Blood Group B	13	74–88	81.00±0.62	3.33±0.42	4.11±0.52
Blood Group O	59	68–94	81.66±0.39	4.44±0.28	5.44±0.34
Females	13	77–91	84.00±0.79	4.23±0.56	5.03±0.67
Solomon Islands					
Males	85	65–88	76.80±0.29	3.93±0.20	5.12±0.26
Blood Group A	29	68–82	76.44±0.39	3.12±0.28	4.08±0.36
Blood Group B	12	68–85	77.75±0.76	3.90±0.54	5.02±0.69
Blood Group O	42	65–88	77.07±0.46	4.41±0.32	5.72±0.42
New Guinea					
Males	50	68–85	76.81±0.29	3.03±0.20	3.94±0.27
Comparative Data					
Polynesia					
Tonga			81.11±0.20	3.16±0.14	3.90±0.17
Samoa			81.22±0.27	3.33±0.19	4.10±0.24
Society Islands			84.96±0.28	3.84±0.20	4.52±0.23
Hawaii			84.01±0.26	3.66	4.4
Marquesas			79.4		
Maori			77.38±0.09	2.89±0.07	3.73±0.09
Melanesia					
New Hebrides					
Tanna			78.87±0.18	3.60±0.13	4.56±0.16
Eromanga			74.79±0.32	3.66±0.23	4.89±0.30
Santa Cruz			76.5		
Loyalty Islands			72.49±0.22	3.09±0.16	4.26±0.22
New Caledonia			76.5		
Namatanai			80.35±0.40	3.02±0.28	3.76±0.35
Baining			83.65±0.23	2.95±0.16	3.53±0.19
Aua Islands			78.73±0.34	2.74±0.24	3.48±0.30
New Guinea					
Sepik River			75.02±0.28	2.76±0.20	3.68±0.27
Jakumul			73.5 ±0.19	2.86±0.14	3.90±0.19
Arup			76.6 ±0.47	3.11±0.33	4.06±0.43
Leitere			77.7 ±0.40	2.69±0.28	3.46±0.36
Torricelli Mts.			77.7 ±0.37	3.02±0.26	3.88±0.34
Potsdamhafen			80.3		
Cape Nelson			75.6		
Kai			79.1		
Central New Guinea			77.4		

TABLE 7

BIZYGOMATIC DIAMETER

	No.	Range	Mean	σ	V
Fiji Islands					
Males	132	130–159	144.05±0.30	5.05±0.21	3.51±0.15
Blood Group A	56	130–159	144.30±0.46	5.10±0.32	3.53±0.22
Blood Group B	13	130–154	142.40±1.00	5.35±0.68	3.76±0.48
Blood Group O	59	130–159	144.20±0.43	4.90±0.30	3.40±0.21
Females	13	125–154	133.90±1.35	7.20±0.95	5.38±0.71
Solomon Islands					
Males	84	115–149	137.95±0.40	5.50±0.29	3.99±0.20
Blood Group A	29	130–149	138.90±0.53	4.20±0.37	3.02±0.27
Blood Group B	12	130–149	138.65±1.07	5.50±0.76	4.04±0.56
Blood Group O	41	125–149	137.72±0.54	5.15±0.38	3.74±0.28
New Guinea					
Males	51	125–154	136.72±0.44	4.62±0.31	3.38±0.23
Comparative Data					
Polynesia					
Tonga			143.47±0.37	5.94±0.26	4.14±0.18
Samoa			145.86±0.43	5.35±0.31	3.67±0.21
Society Islands			145.72±0.38	5.13±0.27	3.52±0.18
Hawaii			144.50±0.42	6.10	4.2
Marquesas			143.2		
Maori			145.74±0.16	4.85±0.11	3.33±0.08
Melanesia					
New Hebrides					
Tanna			144.00±0.28	5.72±0.20	3.97±0.14
Eromanga			141.32±0.51	5.85±0.36	4.14±0.26
Santa Cruz			141.		
Loyalty Islands			142.34±0.30	4.17±0.21	2.93±0.15
New Caledonia			143.1		
Namatanai			137.77±0.69	5.25±0.49	3.81±0.35
Baining			136.47±0.42	5.50±0.30	4.03±0.22
New Guinea					
Jakumul			137.6 ±0.30	4.46±0.21	3.24±0.15
Arup			138.0 ±0.64	4.21±0.45	3.05±0.33
Leitere			139.0 ±0.56	3.80±0.40	2.73±0.28
Torricelli Mts.			133.9 ±0.54	4.38±0.38	3.27±0.28
Potsdamhafen			138.1		
Cape Nelson			133.9		
Kai			137.5		
Central New Guinea			138.		

TABLE 8

CEPHALO-FACIAL INDEX

	No.	Range	Mean	σ	V
Fiji Islands					
Males	132	85–111	93.74±0.20	3.48±0.14	3.71±0.15
Blood Group A	56	88–111	93.92±0.32	3.60±0.23	3.83±0.24
Blood Group B	13	88–102	92.69±0.67	3.57±0.46	3.85±0.49
Blood Group O	59	85–102	93.77±0.29	3.30±0.20	3.52±0.22
Females	13	88–102	92.93±0.71	3.78±0.50	4.07±0.54
Solomon Islands					
Males	84	85–111	95.36±0.28	3.84±0.20	4.03±0.21
Blood Group A	29	85–105	96.02±0.50	3.96±0.35	4.12±0.36
Blood Group B	12	91–111	95.99±1.02	5.25±0.72	5.47±0.75
Blood Group O	41	88–102	94.70±0.33	3.09±0.23	3.26±0.24
New Guinea					
Males	50	88–105	96.61±0.33	3.48±0.23	3.60±0.24
Comparative Data					
Polynesia					
Tonga			92.78±0.22	3.45±0.15	3.72±0.16
Samoa			94.18±0.23	2.84±0.16	3.02±0.17
Society Islands			91.36±0.19	2.65±0.14	2.90±0.15
Hawaii			91.68±0.21	3.07	3.04
Marquesas			93.5		
Maori			94.89±0.11	3.33±0.08	3.50±0.08
Melanesia					
Loyalty Islands			98.87±0.27	3.76±0.19	3.80±0.20
Namatanai			93.38±0.40	3.05±0.29	3.27±0.31
Baining			91.87±0.27	3.56±0.19	3.88±0.21
New Guinea					
Jakumul			97.8 ±0.22	3.32±0.16	3.40±0.15
Arup			95.7 ±0.47	3.10±0.33	3.24±0.35
Leitere			94.9 ±0.46	3.96±0.33	3.32±0.34
Torricelli Mts.			93.5		
Central New Guinea			97.1		

Total Face Height

It is seen that Polynesians as a whole exceed Melanesians as a whole by over a centimeter in average length of face. The Southern New Hebrides group themselves with the Polynesians in this respect, but the Fijians are a little lower. Among the Melanesian groups the mean ranges generally between 112 and 115 mms. It rises in the Solomon Islands somewhat above these limits. In New Guinea, away from the coast, as well as among the Baining and in the Santa Cruz Islands, it falls below them.

Facial Index

The Polynesians are meso- and leptoprosopic as are also the Fijians, Solomonese, and Southern New Hebridians. The longest faces are those of the last-named and of Tonga and Samoa. As in the case of the head measurements, both diameters of the face among Polynesians are greater than among Melanesians, but the larger difference exists in the facial height, and we therefore find from the indices that while they are rounder-headed, they are relatively longer-faced; brachycephalic, though leptoprosopic. The contrast is of course accentuated by the absolutely short faces of the Melanesians.

Compared to the Polynesians, the Fijian faces have practically the same bizygomatic measurement, but are shorter, causing the index to drop. This index is very close to that of the Solomons, but in absolute size the Fijians are considerably ahead; the index in the Solomons rises above that of the rest of Melanesia by virtue of the greater absolute face length. In the Southern New Hebrides the face is very nearly the same size and shape as in Polynesia.

Throughout the rest of Melanesia faces are of much the same absolute size, and euryprosopic.

TABLE 9

TOTAL FACE HEIGHT

	No.	Range	Mean	σ	V
Fiji Islands					
Males	133	105–159	121.80±0.41	6.95±0.29	5.71±0.24
Blood Group A	57	105–134	121.90±0.51	5.75±0.36	4.72±0.30
Blood Group B	13	110–134	123.55±1.06	5.65±0.72	4.57±0.58
Blood Group O	59	105–159	121.40±0.69	7.85±0.49	6.47±0.40
Females	13	100–129	114.30±1.08	5.75±0.76	5.03±0.67
Solomon Islands					
Males	85	100–129	116.40±0.48	6.61±0.34	5.68±0.29
Blood Group A	29	105–129	117.00±0.73	5.85±0.52	5.00±0.44
Blood Group B	12	100–129	115.75±1.69	8.70±1.20	7.52±1.04
Blood Group O	42	100–129	116.50±0.66	6.35±0.47	5.45±0.40
New Guinea					
Males	51	95–124	112.48±0.56	5.92±0.40	5.26±0.35
Comparative Data					
Polynesia					
Tonga			128.15±0.43	6.80±0.30	5.31±0.24
Samoa			131.07±0.53	6.47±0.37	4.94±0.28
Society Islands			124.78±0.46	6.35±0.33	5.09±0.26
Hawaii			125.43±0.47	6.69	5.3
Marquesas			124.1		
Maori			124.17±0.20	5.96±0.14	4.80±0.11
Melanesia					
New Hebrides					
Tanna			124.95±0.42	8.47±0.30	6.78±0.24
Eromanga			125.15±0.69	7.90±0.49	6.31±0.39
Santa Cruz			109.5		
Loyalty Islands			118.30±0.43	6.00±0.31	5.07±0.26
New Caledonia			114.9		
Namatanai			114.46±0.65	4.91±0.46	4.29±0.40
Baining			110.15±0.46	6.08±0.32	5.52±0.30
New Guinea					
Jakumul			112.2 ±0.42	6.16±0.29	5.49±0.26
Arup			114.1 ±0.85	5.61±0.60	4.92±0.52
Leitere			111.9 ±0.76	5.14±0.53	4.59±0.48
Torricelli Mts.			108.7 ±0.82	6.64±0.58	6.11±0.53
Potsdamhafen			115.6		
Cape Nelson			112.9		
Kai			107.4		
Central New Guinea			112.		

TABLE 10

FACIAL INDEX

	No.	Range	Mean	σ	V
Fiji Islands					
Males	132	74–105	84.70±0.30	5.04±0.21	5.95±0.25
Blood Group A	56	74–97	84.78±0.40	4.40±0.28	5.19±0.33
Blood Group B	13	74–97	86.40±1.01	5.40±0.69	6.21±0.79
Blood Group O	59	74–105	84.18±0.48	5.48±0.44	6.51±0.40
Females	13	74–93	82.58±0.89	4.76±0.63	5.76±0.76
Solomon Islands					
Males	84	74–97	84.54±0.32	4.36±0.23	5.17±0.27
Blood Group A	29	78–93	84.62±0.49	3.88±0.34	4.59±0.41
Blood Group B	12	74–93	82.82±0.76	3.92±0.54	4.73±0.65
Blood Group O	41	74–97	85.06±0.49	4.68±0.35	5.50±0.41
New Guinea					
Males	51	70–93	82.72±0.46	4.86±0.32	5.88±0.39
Comparative Data					
Polynesia					
Tonga			89.25±0.28	4.43±0.20	4.96±0.22
Samoa			89.87±0.40	4.85±0.28	5.40±0.31
Society Islands			85.73±0.33	4.48±0.23	5.23±0.27
Hawaii			86.74±0.35	4.69	5.4
Marquesas			87.0		
Maori			84.76±0.15	4.57±0.11	5.39±0.13
Melanesia					
New Hebrides					
Tanna			86.98±0.27	5.52±0.19	6.35±0.22
Eromanga			88.98±0.49	5.56±0.35	6.25±0.39
Santa Cruz			78.0		
Loyalty Islands			83.06±0.34	4.71±0.24	5.67±0.29
New Caledonia			80.4		
Namatanai			83.46±0.57	4.35±0.41	5.21±0.49
Baining			80.77±0.37	4.85±0.26	6.00±0.32
New Guinea					
Jakumul			80.8 ±0.30	4.45±0.21	5.50±0.26
Arup			82.2 ±0.68	4.50±0.48	5.48±0.58
Leitere			79.8 ±0.53	3.63±0.38	4.54±0.47
Torricelli Mts.			81.1 ±0.57	4.59±0.40	5.65±0.49
Potsdamhafen			83.7		
Cape Nelson			84.2		
Kai			78.4		
Central New Guinea			81.6		

NOSE HEIGHT

Although there is a fairly wide range for the means of nose height among the Polynesians, all of them are higher than those for any group in Melanesia, again excepting the Southern New Hebrides. The Fijians, though shorter of nose than the Polynesians, are yet longer than the other Melanesians, though this is to be expected, since the Fijians are slightly larger in every way than the latter. There is a surprising bunching of the means for this dimension on the coast of New Guinea; the average is slightly more than that for the smaller islands, and is probably a metrical expression of the renowned "Semitic" nose of these people. The shortest noses are those of the Kai, somewhat removed from the coast, although the Central group, much further inland, has a mean as high as the coastal groups.

NOSE BREADTH

With the exception of the Maori, who have the narrowest noses among our comparative groups the means for nose breadth of Polynesians are very close to each other, between 43 and 44 mm. In the southern New Hebrides noses are slightly narrower. In Melanesia there is a moderate amount of diversity, the tendency being toward noses absolutely a little wider than those of the Polynesians, excepting for the Kai and Namatanai people. On the coast of New Guinea, Schlaginhaufen's figures indicate noses approximating those of Polynesians in width, while the present data would make them distinctly wider. The widest means found include these latter and those for Fiji, New Caledonia, and the Baining.

NASAL INDEX

The nasal index, in spite of its great variability, nevertheless exhibits a certain consistency in its distribution throughout the Pacific. Polynesia (with the Southern New Hebrides) gravitates about a center a few points below 80; this is distinctly less platyrrhine than among the Melanesians. With the exception of coastal New Guinea, the latter range through the upper eighties and the nineties, Fiji and the Solomons being lowest, and the Baining and New Caledonia the highest. The coastal New Guinea groups, both of Schlaginhaufen and Bondy-Horowitz, are lower than other Melanesians, falling between 83 and 87, while the inland Kai and Wirz's mountain people are over 90.

A discrepancy is noted between the above groups on the New Guinea coast and the corresponding sample in the present material; this agrees

with differences in the means of the height and breadth, for the latter groups are both shorter and broader. This is very puzzling. It does not appear to be due to differences in technique. We do not know, however, whether this group is strictly coastal or includes inland people, whose noses, as other data indicate, have higher indices.

TABLE 11

NOSE HEIGHT

	No.	Range	Mean	σ	V
Fiji Islands					
Males	133	44–63	52.42±0.23	3.88±0.16	7.40±0.31
Blood Group A	57	44–63	52.46±0.35	3.88±0.25	7.40±0.47
Blood Group B	13	48–59	52.58±0.43	2.28±0.29	4.34±0.55
Blood Group O	59	44–63	52.50±0.37	4.16±0.26	7.92±0.49
Females	13	48–59	51.02±0.46	2.48±0.33	4.86±0.64
Solomon Islands					
Males	85	40–59	49.86±0.28	3.84±0.20	7.70±0.40
Blood Group A	29	44–59	50.46±0.37	2.92±0.26	5.79±0.51
Blood Group B	12	40–55	49.82±0.80	4.12±0.57	8.27±1.14
Blood Group O	42	40–59	49.58±0.45	4.23±0.32	8.71±0.64
New Guinea					
Males	51	40–55	49.82±0.24	2.58±0.17	5.18±0.35
Comparative Data					
Polynesia					
Tonga			57.40±0.23	3.76±0.17	6.55±0.29
Samoa			59.81±0.30	3.66±0.21	6.12±0.35
Society Islands			54.21±0.26	3.51±0.18	6.47±0.33
Hawaii			55.60±0.27	3.87	7.0
Marquesas			53.1		
Maori			52.82±0.12	3.53±0.08	6.68±0.15
Melanesia					
New Hebrides					
Tanna			58.34±0.27	5.36±0.19	9.19±0.32
Eromanga			55.40±0.65	7.45±0.46	13.45±0.84
Loyalty Islands			49.51±0.27	3.71±0.19	7.49±0.38
New Caledonia			47.9		
Namatanai			48.40±0.43	3.22±0.31	6.65±0.63
Baining			48.94±0.25	3.25±0.18	6.64±0.36
New Guinea					
Jakumul			50.6 ±0.24	3.53±0.17	6.98±0.33
Arup			52.0 ±0.38	2.53±0.27	4.86±0.52
Leitere			51.1 ±0.48	3.29±0.34	6.44±0.67
Torricelli Mts.			50.9 ±0.49	3.8	
Potsdamhafen			51.6		
Cape Nelson			51.6		
Kai			45.5		
Central New Guinea			50.		

TABLE 12

NOSE BREADTH

	No.	Range	Mean	σ	V
Fiji Islands					
Males	133	37–54	46.19±0.18	3.03±0.13	6.56±0.27
Blood Group A	57	37–54	46.25±0.29	3.21±0.20	6.94±0.44
Blood Group B	13	40–51	45.86±0.52	2.79±0.36	6.08±0.78
Blood Group O	59	40–54	46.25±0.24	2.79±0.17	6.03±0.37
Females	13	34–48	41.92±0.35	1.86±0.25	4.44±0.59
Solomon Islands					
Males	85	34–51	44.60±0.20	2.79±0.14	6.26±0.32
Blood Group A	29	34–51	44.72±0.38	3.00±0.27	6.71±0.59
Blood Group B	12	40–51	44.24±0.50	2.58±0.36	5.83±0.80
Blood Group O	42	37–51	43.28±0.28	2.67±0.20	6.17±0.45
New Guinea					
Males	51	40–54	45.99±0.30	3.17±0.21	6.89±0.46
Comparative Data					
Polynesia					
Tonga			44.40±0.19	3.03±0.13	6.82±0.30
Samoa			43.80±0.21	2.59±0.15	5.91±0.34
Society Islands			43.40±0.20	2.77±0.14	6.37±0.33
Hawaii			43.53±0.21	3.02	6.9
Marquesas			43.2		
Maori			40.08±0.08	2.43±0.06	6.06±0.14
Melanesia					
New Hebrides					
Tanna			42.78±0.21	4.22±0.15	9.86±0.35
Eromanga			42.28±0.32	3.69±0.23	8.73±0.54
Santa Cruz			46.		
Loyalty Islands			45.14±0.18	2.52±0.13	5.58±0.29
New Caledonia			47.3		
Namatanai			42.50±0.48	3.61±0.34	8.49±0.80
Baining			47.06±0.30	3.94±0.21	8.37±0.45
New Guinea					
Jakumul			44.0 ±0.21	3.05±0.15	6.94±0.33
Arup			45.4 ±0.48	3.17±0.34	6.97±0.74
Leitere			42.7 ±0.28	1.93±0.20	4.53±0.47
Torricelli Mts.			44.3 ±0.49	3.86±0.35	8.69±0.78
Potsdamhafen			43.9		
Cape Nelson			43.7		
Kai			41.1		
Central New Guinea			45.		

TABLE 13

NASAL INDEX

	No.	Range	Mean	σ	V
Fiji Islands					
Males	133	68–123	88.78±0.48	8.28±0.34	9.33±0.39
Blood Group A	59	68–123	89.22±0.86	9.60±0.61	10.76±0.68
Blood Group B	13	76–103	87.02±1.19	6.36±0.84	7.31±0.97
Blood Group O	59	72–103	88.26±0.62	7.04±0.44	7.98±0.50
Females	13	64– 95	83.02±1.29	6.92±0.92	8.34±1.10
Solomon Islands					
Males	85	68–119	87.14±0.65	8.92±0.46	10.24±0.53
Blood Group A	29	68–104	85.10±0.99	7.88±0.70	9.26±0.82
Blood Group B	12	76–119	91.18±2.05	10.52±1.45	11.35±1.56
Blood Group O	42	72–107	87.22±0.89	8.52±0.63	9.77±0.72
New Guinea					
Males	51	76–119	92.78±0.85	9.03±0.60	9.73±0.65
Comparative Data					
Polynesia					
Tonga			77.60±0.47	7.58±0.33	9.77±0.43
Samoa			73.59±0.48	5.87±0.34	7.98±0.46
Society Islands			80.32±0.53	7.22±0.37	8.99±0.46
Hawaii			78.41±0.55	7.24	9.2
Marquesas			81.9		
Maori			75.72±0.24	7.22±0.17	9.54±0.22
Melanesia					
New Hebrides					
Tanna			74.10±0.47	9.50±0.33	12.82±0.45
Eromanga			77.50±1.04	11.80±0.73	15.23±0.95
Loyalty Islands			91.65±0.61	8.32±0.43	9.08±0.46
New Caledonia			99.3		
Namatanai			88.40±1.04	7.85±0.73	8.88±0.83
Baining			96.54±0.68	8.94±0.48	9.26±0.50
New Guinea					
Jakumul			86.8 ±0.52	7.67±0.37	8.84±0.42
Arup			87.2 ±1.19	7.88±0.84	9.04±0.96
Leitere			83.2 ±0.76	5.15±0.54	6.18±0.64
Torricelli Mts.			87.4 ±0.96	7.55±0.68	8.64±0.78
Potsdamhafen			85.2		
Cape Nelson			85.1		
Kai			90.1		
Central New Guinea			92.7		

TABLE 14

SUMMARY OF MEANS

Males

Measurements	Fiji	Solomon Islands	New Guinea
Stature	170.85	160.20	159.00
Sitting Height	88.33	83.59	81.41
Head Length	188.82	188.46	184.95
Head Breadth	153.67	144.73	141.83
Bizygomatic Diameter	144.05	137.95	136.72
Total Face Height	121.80	116.40	112.48
Nose Height	52.42	49.86	49.82
Nose Breadth	46.19	44.60	45.99
Indices			
Relative Sitting Height	51.73	52.12	51.12
Cephalic Index	81.54	76.80	76.81
Cephalo-facial Index	93.74	95.36	96.61
Facial Index	84.70	84.54	82.72
Nasal Index	88.78	87.14	92.78

SUMMARY OF MEASUREMENTS AND INDICES

Excepting for the moment the present material and that from the islands of Tanna and Eromanga, the various series which have been listed for comparison may be split into four generalized geographical groups: Polynesian, island Melanesian, coastal New Guinea, and inland New Guinea. This is an arbitrary division, used only as a working basis for summarizing and clarifying the results of the measurements and indices. Nor is it to be understood that we are comparing Polynesians and Melanesians as racially homogeneous types; our present purpose is simply to get some generalized contrast between the two, and the separation of the New Guinea groups from the Melanesians is more or less of an afterthought.

The contrast we seek is well marked in the following characters: stature, head breadth, face width, face height, facial index, nose height, and nasal index, or seven out of the eleven for which we have comparative data. In them there is no overlapping between the Polynesian group and the others. The Polynesians are taller, have absolutely broader heads and faces, and absolutely and relatively longer faces; the greatest differences exist in the head breadth and the face length. Among the other groups, the inland New Guinea division tends to be smaller in all dimensions, and to have relatively shorter faces than the others, while the people of the coast are a trifle less in head and face width than the people of the islands. In the absolute and relative height of the nose there is no overlapping between Polynesia, coastal New Guinea, or Melanesia; apparently the "Semitic" nose of New Guinea asserts itself, to place this group in a position intermediate to Melanesia and Polynesia.

In the length of the head and the cephalic index, there is such variation in all groups, particularly the Melanesians, that a line cannot be drawn, although by and large the Polynesians are greater in absolute length and higher in the index. The cephalo-facial index requires too much interpretation to be of much use as a criterion of differentiation. In the case of the nasal breadth the Melanesian means are, with one exception, all higher than the Polynesian, but between the latter and New Guinea there is no discernible difference.

Along with the distinctions already seen, it should be remarked that the Polynesians, taken as a racial group, are more homogeneous than the Melanesians; the latter, taken as a group, vary rather widely, as exemplified by the samples under consideration here. This is, of course, the accepted idea.

How, then, do the Fijians fit into the pattern as outlined? In three of the seven contrasting characters named above, the mean falls within the limits of the Polynesian group: these characters are stature, head breadth, and face breadth. In three more of the seven, facial height and index and nasal height, the mean is to be found between the lower limit of the Polynesians and the upper limits of the Melanesian-New Guinea groups. Further, in the nasal height, the Fijians are between the Polynesians and the New Guinea group, well above their nearer Melanesian neighbors. The seventh character, however, the nasal index, finds the Fijians definitely within the Melanesian limits, being even more platyrrhine than the people of coastal New Guinea.

Turning to the features in which the geographical differences are less pronounced, we see that the moderately long head of Fiji is only a little above the average, and might thus be a likeness to either western or eastern neighbors. But, as we have seen, the breadth of the head is of a Polynesian size, leading us therefore to conclude that in absolute dimensions and cephalic index the Fijians should be classed with the Polynesians. In considering the cephalo-facial index the same argument applies; although there is no definite geographical distinction, it may be said that the Fijians belong with Polynesians in index because they so definitely belong with them in head and face breadth. The nasal breadth is another matter, the mean being unquestionably Melanesian in size.

Describing the Fijians in terms of Polynesian and Melanesian, we at once remark that for the measurements here used the score runs heavily in favor of the former. In height and in the size and shape of the head Fiji and Polynesia are one. Also in the breadth of the face and its relation to the head breadth; in regard to the height and index of the face Fiji is intermediate between Polynesia and Melanesia, being shorter than the former. The nose, though not extremely platyrrhine, is Melanesian in shape, though larger in size.

When we apply the same process of comparison to the Solomon Islands we find that here there is no question of Polynesian affinities. Briefly they are short and narrow-headed; their faces are narrow and short in an absolute sense, though the facial index is the one character in which they are higher than Melanesians and close to Polynesians; the dimensions of the nose are Melanesian, though the index is not excessively high. For closer analysis therefore, these people must be compared to their various Melanesian neighbors. In stature and the diameters and index of the head they are very near the people of the Santa Cruz

Islands, though there resemblances cease; for the faces of the former are longer, and both faces and noses are narrower. In the dimensions and index of the nose the Solomonese seem to stand between the island Melanesian and coastal New Guinea divisions, being somewhat less platyrrhine than the former. It becomes obvious, though, that the usefulness of treating the people of the smaller Melanesian islands as a unit has already expired.

Our New Guinea sample calls for but a fleeting glance. It differs from the comparative data from the coast of New Guinea only in the measurements and index of the nose. It is not certain that our subjects are all from the coast; or perhaps the difference may be due to a slight variation in technique.

So far we have not considered Tanna and Eromanga, but to do so now may be profitable. Offhand classification on the basis of external characteristics would stamp them as Melanesian in type, the Eromangans more definitely so than the Tannese, who vary more, according to Humphreys, in skin color. What effect upon these people, then, has Polynesian admixture had somatologically? Their long and narrow noses and their long and relatively narrow faces are definitely Polynesian characteristics, although only the Tannese are Polynesian in the absolute breadth of the face. The Eromangans are dolichocephalic and resemble the Melanesians in mean head length and breadth, while the greater head width in Tanna places this group in an intermediate position with regard to head size and shape. In stature both peoples are medium, being below their neighbors of New Caledonia and the Loyalties, though above other Melanesians.

From these facts we may conclude that the two islands have been strongly Polynesianized, Eromanga only slightly less than Tanna. However, these influences have not produced a breed like the Fijians, for the characteristics in which these islanders approach the Polynesians are almost all other than those in which the Fijians behave similarly. This may be due to a difference between the Polynesian components of the two groups, though the homogeneity of the Polynesians as a whole does not lend much support to the idea. Again, it may be explained by differences in the Melanesian stock concerned, though certain other factors, such as the nose form, are opposed to such an explanation. I am inclined to believe that both possibilities are accountable.

I have thought it inadvisable to attempt to arrive at inter-group relationships by calculating mean differences for the measurements, or by expressing these as multiples of their probable errors. These methods

are excellent when the differences are slight, and the groups to be classified are in some sense parts of a whole. Here, however, the problem is a broad one; differences are gross and irregular and the number of measurements available is small; therefore, simple inspection is the safest and most informative kind of comparison. In any case, if we applied the above methods to the Fijians and found them to give a lesser mean difference from one Polynesian group than another, we should not, knowing them to be a mixed group and really outside the Polynesian pale, be able to place a sound interpretation on this result.

Concerning comparative variability there is not a great deal to say. In the list below is given the mean coefficient of variation for several groups; this is calculated from seven measurements, or all except sitting height.

Fiji	4.94
Solomon Islands	4.99
Tonga	4.58
Samoa	4.23
Society Islands	4.50
Hawaii	4.86
Maori	4.28
New Hebrides	
Tanna	5.83
Eromanga	6.07
Loyalty Islands	4.27
Namatanai	4.74
Baining	4.95

There are no clear-cut distinctions to be made, although there is some slight support for the notion that mixed groups are more variable. However, according to the figures, the Solomon Islanders have as great a variability as the Fijians, as do the Baining, while the Loyalty Islanders are almost the least variable of all. That in Tanna and Eromanga we get far the highest variability of all indicates the probability that these hybrids are recent, compared with the Fijians.

OBSERVATIONS

Skin color was recorded with von Luschan's scale. In tabulating tints which naturally resembled each other were grouped for economy of space. The Fijians are seen to be distinctly lighter than the Solomon Islanders; in fact, the two groups barely overlap, although the former do not approach Polynesian standards of fairness.

The form of the hair presents a puzzling situation in that the Fijians have more woolly hair than the Solomons people, though every sign has led us to suppose the former to be less negroid than the latter.[1] Woolly hair is exceptional in Polynesia. Both Fiji and the Solomons are contrasted with New Guinea, where woolly-headedness approaches 100 per cent. In Fiji as well as Polynesia, the hair color is almost entirely black, and the Solomons become conspicuous in having as high as 30 per cent of a shade even so slightly different as dark brown. Although in New Guinea the percentage is somewhat obscured by the use of lime in the coiffure, the probability is that the natural color is black throughout.

In observations on the amount of hair of the head and face, the personal equation is large. Among the Polynesians, however, Tongans have moderately heavy beards, and Society Islanders light ones, with Samoans intermediate. The Fijians, with heavier beards than the solomon Islanders, are much the same as the Tongans in percentage distribution.

The iris of the eye is almost universally dark brown. The epicanthic fold is very much rarer than in Polynesia, and no difference between the three groups is apparent.

Compared to Polynesians the lip is very thick in these Melanesians; it is thickest in New Guinea, and least so in Fiji. The series are all alike in the types of tooth bite.

[1]In recording, Doctor Moss apparently used "curly" to designate a hair form between "frizzly" and "woolly" rather than "ringlets."

TABLE 15

SKIN COLOR—FOREHEAD

Von Luschan Scale	22–23		24–25		26		27–30		31		32		33–34		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Fiji Islands															
Males	40	30.08	88	66.17	5	3.76									133
Blood Group A	16	28.07	39	68.42	2	3.51									57
Blood Group B	2	15.38	9	69.23	2	15.38									13
Blood Group O	22	37.29	36	61.02	1	1.69									59
Females	11	84.62	2	15.38											13
Solomon Islands															
Males			4	4.71	5	5.58	71	83.53	3	3.53			2	2.35	85
Blood Group A			1	3.45	1	3.45	25	86.21	2	6.90					29
Blood Group B					1	8.33	11	91.67							12
Blood Group O			3	7.14	3	7.14	33	78.57	1	2.38			2	4.76	42
New Guinea															
Males	1	2.00	4	8.00	5	10.00	39	78.00			1	2.00			50

TABLE 16

SKIN COLOR—VOLAR SURFACE OF FOREARM

Von Luschan Scale	19–21		22–23		24–25		26		27–30		31		33–34		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Fiji Islands															
Males			67	50.76	60	45.45	5	3.79							132
Blood Group A			31	54.39	24	42.11	2	3.51							57
Blood Group B			5	38.46	6	46.15	2	15.38							13
Blood Group O			30	51.72	27	46.55	1	1.72							58
Females	2	15.38	10	76.92	1	7.69									13
Solomon Islands															
Males			1	1.18	8	9.41	30	35.29	42	49.41	2	2.35	2	2.35	85
Blood Group A					2	6.90	12	41.38	15	51.72					29
Blood Group B					1	8.33	4	33.33	7	58.33					12
Blood Group O			1	2.38	5	11.90	14	33.33	19	45.24	1	2.38	2	4.76	42
New Guinea															
Males			1	1.96	9	17.65	15	29.41	21	41.18	5	9.80			51

TABLE 17

HAIR FORM

	Straight		Low Waves		Frizzly		Curly		Woolly		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	
Fiji Islands											
Males					38	32.76	19	16.38	59	50.86	116
Blood Group A					14	28.57	9	18.37	26	53.06	49
Blood Group B					4	33.33	1	8.33	7	58.33	12
Blood Group O					19	37.26	8	15.69	24	47.05	51
Females					3	27.27	5	45.45	3	27.27	11
Solomon Islands											
Males	2	3.28	1	1.64	17	27.87	16	26.23	25	40.98	61
Blood Group A			1	4.76	7	33.33	3	14.29	10	47.62	21
Blood Group B					1	14.29	3	42.86	3	42.86	7
Blood Group O	2	6.25			8	25.00	10	31.25	12	37.50	32
New Guinea											
Males							1	2.17	46	97.87	47

TABLE 18

HAIR COLOR

	Black		Dark Brown		Red Brown		Light Brown		Limed Black		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	
Fiji Islands											
Males	118	90.77	9	6.92	3	2.31					130
Blood Group A	51	89.47	4	7.02	2	3.51					57
Blood Group B	13	100.00									13
Blood Group O	50	89.29	5	8.93	1	1.79					56
Females	12	92.31			1	7.69					13
Solomon Islands											
Males	55	64.71	26	30.59			3	3.53	1	1.18	85
Blood Group A	22	78.57	6	21.43							28
Blood Group B	8	66.67	4	33.33							12
Blood Group O	24	57.14	15	35.71			3	7.14			42
New Guinea											
Males	30	58.82							21	41.18	51

TABLE 19

AMOUNT OF HAIR—HEAD

	Large		Very Large		Total
	No.	%	No.	%	
Fiji Islands					
Males	1	0.75	132	99.25	133
Blood Group A			57	100.00	57
Blood Group B	1	7.69	12	92.31	13
Blood Group O			59	100.00	59
Females			13	100.00	13
Solomon Islands					
Males	5	5.88	80	94.12	85
Blood Group A	1	3.45	28	96.55	29
Blood Group B			5	100.00	5
Blood Group O	4	9.53	38	90.48	42
New Guinea					
Males			51	100.00	51

TABLE 20

AMOUNT OF HAIR—MOUSTACHE

	Absent		Small		Medium		Large		Very Large		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	
Fiji Islands											
Males	4	3.03	1	0.76	69	52.27	44	33.33	14	10.61	132
Blood Group A	3	5.26			27	47.37	21	36.84	6	10.53	57
Blood Group B					6	46.15	5	38.46	2	15.38	13
Blood Group O			1	1.72	33	56.90	18	31.03	6	10.34	58
Females	7	53.85	3	23.08	3	23.08					13
Solomon Islands											
Males	5	5.88			52	61.18	26	30.59	2	2.35	85
Blood Group A					18	62.07	10	34.48	1	3.45	29
Blood Group B	1	8.33			6	50.00	5	41.67			12
Blood Group O	3	7.14			27	64.29	11	26.19	1	2.38	42
New Guinea											
Males	5	9.80	1	1.96	25	49.02	20	39.22			51

TABLE 21

AMOUNT OF HAIR—CHEEKS

	Absent		Small		Medium		Large		Very Large		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	
Fiji Islands											
Males	27	20.61	2	1.53	44	33.59	46	35.11	12	9.16	131
Blood Group A	11	19.30			20	35.09	20	35.09	6	10.53	57
Blood Group B	2	15.38			4	30.77	7	53.85			13
Blood Group O	14	24.56	2	3.51	16	28.07	19	33.33	6	10.53	57
Females	12	92.31	1	7.69							13
Solomon Islands											
Males	21	24.71			42	49.41	22	25.88			85
Blood Group A	4	13.79			17	58.62	8	27.59			29
Blood Group B	4	33.33			4	33.33	4	33.33			12
Blood Group O	11	26.19			21	50.00	10	23.81			42
New Guinea											
Males	16	31.37	4	7.84	23	45.10	8	15.69			51

TABLE 22

AMOUNT OF HAIR—CHIN

	Absent		Small		Medium		Large		Very Large		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	
Fiji Islands											
Males	9	6.87			52	39.69	56	42.75	14	10.69	131
Blood Group A	3	5.27			22	38.60	25	43.86	7	12.28	57
Blood Group B					6	46.15	7	53.85			13
Blood Group O	6	10.53			21	36.84	23	40.35	7	12.28	57
Females	11	84.62	1	7.69	1	7.69					13
Solomon Islands											
Males	7	8.24			53	62.35	25	29.41			85
Blood Group A					20	68.97	9	31.03			29
Blood Group B	1	8.33			6	50.00	5	41.67			12
Blood Group O	5	11.90			26	61.90	11	26.19			42
New Guinea											
Males	13	25.49	2	3.92	24	47.06	12	23.53			51

TABLE 23

EYE COLOR

	Dark Brown		Light Brown		Other		Total
	No.	%	No.	%	No.	%	
Fiji Islands							
Males	130	98.48	2	1.52			132
Blood Group A	56	98.25	1	1.75			57
Blood Group B	12	92.31			1	7.69	13
Blood Group O	58	98.31	1	1.69			59
Females	13	100.00					13
Solomon Islands							
Males	85	100.00					85
New Guinea							
Males	51	100.00					51

TABLE 24

EPICANTHIC FOLD

	Absent		Submedium		Medium		Total
	No.	%	No.	%	No.	%	
Fiji Islands							
Males	116	89.23	7	5.38	7	5.38	130
Blood Group A	49	85.96	5	8.77	3	5.26	57
Blood Group B	11	84.62			2	15.38	13
Blood Group O	52	92.86	2	3.57	2	3.57	56
Females	11	84.62			2	15.38	13
Solomon Islands							
Males	80	94.12	2	2.35	3	3.53	85
Blood Group A	26	89.66	1	3.45	2	6.90	29
Blood Group B	11	91.67	1	8.33			12
Blood Group O	41	97.62			1	2.38	42
New Guinea							
Males	45	88.24	3	5.88	3	5.88	51

TABLE 25

INTEGUMENTAL LIP

	Medium		Pronounced		Very Pronounced		Total
	No.	%	No.	%	No.	%	
Fiji Islands							
Males	1	0.75	26	19.55	106	79.70	133
Blood Group A			8	14.04	49	85.96	57
Blood Group B			1	7.69	12	92.31	13
Blood Group O	1	1.69	16	27.12	42	71.19	59
Females			1	7.69	12	92.31	13
Solomon Islands							
Males			12	14.12	73	85.88	85
Blood Group A			2	6.90	27	93.10	29
Blood Group B			2	16.67	10	83.33	12
Blood Group O			8	19.05	34	80.95	42
New Guinea							
Males			2	3.92	49	96.08	51

TABLE 26

TOOTH BITE

	Slight Over		Edge to Edge		Under		Total
	No.	%	No.	%	No.	%	
Fiji Islands							
Males	77	58.78	50	38.17	4	3.05	131
Blood Group A	33	58.93	22	39.29	1	1.79	56
Blood Group B	9	69.23	3	23.08	1	7.69	13
Blood Group O	33	56.90	23	39.66	2	3.45	58
Females	12	92.31			1	7.69	13
Solomon Islands							
Males	45	54.22	37	44.58	1	1.20	83
Blood Group A	14	50.00	13	46.43	1	3.57	28
Blood Group B	8	66.67	4	33.33			12
Blood Group O	23	56.10	18	43.90			41
New Guinea							
Males	31	60.78	19	37.25	1	1.96	51

RESULTS OF SORTING

If the Fijians are a mixed group racially, this should be demonstrable without great difficulty by means of some simple calculations. We suppose that the Fijian is a mingling of the Polynesian and the Oceanic Negro, two morphologically distinct groups, and that time and isolation have not been sufficient to afford the mixture the dignity of a race. It may be discovered that while the morphology of the whole group approximates a blend, individuals may tend to approach one or the other of the parent forms in a complex of features, perhaps because a majority of their inheritance comes from one side, but more probably through the genetic process of segregation through linkage. This phenomenon has been generally remarked in studies of race crossing.

It should then be possible, by a process of sorting, to obtain a subgroup which varies in a large number of characters towards one of the original groups. The present series is not large and the observations suitable for the purpose are few, but we may make an attempt in this direction by sorting for Polynesian and Melanesian variations of hair form, skin color, and the nasal index. These standards are only relative, not absolute; we have no real Polynesian skin or hair, but simply take the least Melanesian forms to be found. We have 115 subjects. From the percentage distributions of these in the categories we have chosen[1] it may be calculated that pure chance would give us a "Polynesian" group (light skin, straighter hair, less platyrrhine nose) numbering eight or nine (8.62) and a "Melanesian" group numbering nine or ten (9.83)[2]. The actual sorting gives sixteen "Polynesians" and seventeen "Melanesians." These numbers are close to twice the expectancy, and indicate that there is a slight but persistent tendency among individuals towards a linking together of those forms of their various bodily features which make up the pattern of one of the parent groups.

Another form of attack may be followed in sorting the material into types on the basis of two characters, the individuals being placed in two groups according to whether they exhibit "Polynesian" or "Melanesian" variations of these characters. After discarding all intermediate or "disharmonic" subjects, the groups are large enough to give some weight to the results. For the total group the following coefficients of mean square contingency are found:—

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[1] "Polynesian" forms: hair, frizzly; skin, 22–23; nasal index, 68–83. "Melanesian" forms: hair, woolly; skin, 24–26; nasal index, 92–111.

[2] These are actually Independence Frequencies.

Characters	Number	Coefficient
Skin Color, Forearm, and Hair Form	115	.26
Hair Form and Nasal Index	116	.50
Hair Form and Facial Index	115	.36

The coefficient of correlation between the nasal and facial indices, the number being 132, is $-.46 \pm .05$. None of these figures is remarkable, as the coefficient of contingency is raised unreasonably in a small sample when one variable has a large number of classes, such as the nasal index. The correlation between the forms of the face and nose is likewise partly spurious. Nevertheless, as an experiment, two pairs of groups were formed and their means for all measurements calculated. These are defined below, under the characteristics by which they were sorted.

Hair form and skin color, forearm:—

A. "Polynesians": frizzly hair with skin color numbers 22-25; N = 37

A′. "Melanesians": woolly hair with skin color numbers 24-26; N = 36

Nasal and facial indices:—

B. "Polynesians": long faces and noses; nasal index 68–91; facial index 82–105; N = 64

B′. "Melanesians": short faces and noses; nasal index 88–123; facial index 74–85[1]; N = 46

The means of all measurements, excepting those used for sorting, are given for all the groups, with those of the total group, in Table 27.

TABLE 27

MEANS OF GROUPS OBTAINED BY SORTING

	"Polynesian"		Total Fiji	"Melanesian"	
	A	B		B′	A′
Stature	171.16	172.23	170.85	169.05	170.50
Sitting Height	88.16	88.66	88.33	87.94	88.83
Relative Sitting Height	51.69	51.50	51.73	52.11	52.27
Head Length	189.65	189.00	188.82	189.66	189.08
Head Breadth	154.65	154.06	153.67	153.34	153.50
Cephalic Index	81.66	81.56	81.54	80.94	81.50
Bizygomatic Breadth	142.81		144.05		144.92
Cephalo-Facial Index	91.75	92.87	93.74	95.00	94.42
Facial Height	122.55		121.80		121.17
Facial Index	85.66		84.70		83.50
Nose Height	53.72		52.42		51.17
Nose Breadth	45.78		46.19		46.42
Nasal Index	85.72		88.78		90.83

[1]From both B and B′ are excepted the group common to both, nasal index 88–91 and facial index 82–85.

The differences are slight,[1] but they gather importance from the constancy of the direction which they take. It must be remembered that we are not dealing with alien elements, but with portions of the same population. The "Melanesian" groups lean almost always in a Melanesian direction in those characters in which a distinction can be made (as previously set forth). The important exception is the bizygomatic diameter, which behaves contrary to expectation, being slightly greater for the "Melanesian" group A′. This, together with the definite tendencies in the expected direction among the indices, suggests that it is the form, and not the absolute size, which recedes toward one parent form in segregation. That is to say, Polynesians differ from Melanesians in having longer and broader, but relatively narrower faces; while our "Polynesians" differ so slightly from the "Melanesian" groups that they must choose between a relatively narrower face or an absolutely broader one in their approach to true Polynesians; apparently they choose the former.

It must be revealed, though I do not believe that it voids the evidence, that there is some overlapping between the groups as drawn. Although the A and B groups were sorted by independent pairs of characters, group B ("Polynesian") contains 42 per cent of group A ("Polynesian") as against 19 per cent of group A′ (with 39 per cent of misfits), and group B′ ("Melanesian") contains only 26 per cent of A and 39 per cent of A′ (with 35 per cent of misfits). However, this is as much an affirmation as a betrayal of the findings.

There seems thus to be support, consistent though tenuous, for the proposition that the Fijians reveal their ancestry through segregation, and that while these generalized throwbacks to the parent forms are neither pronounced nor universal in their occurrence, they appear to receive preference over mere chance. Furthermore, this phenomenon may be detected by statistical methods.

[1]The probable errors of these differences, in general, show them to be significant only for the indices and not for the measurements.

BLOOD TYPES

The bearing of the blood agglutination groups upon questions of racial history and relationships is at present highly indeterminate both in quantity and quality. The fact that blood types are inherited as a unit character has rendered the study of great importance to the more purely biological aspects of anthropology. Some years ago L. and H. Hirzfeld originated the vogue of collecting mass data on populations the world over, with the purpose of attacking racial problems with the percentage distribution of the four blood groups as a weapon (Parr).

There are now two journals devoted exclusively to the study of blood grouping, and some populations are being typed wholesale, the Germans and the Japanese being particularly voracious in this direction. Steffan and Wellisch in the *Zeitschrift für Rassenphysiologie* have already compiled standardized data on about 700 different groups. Besides giving percentages of the four groups, other constants have been introduced, denoted p, q, and r, which represent the actual proportions of the A, B, and O factors in any sample. The formulae for these, devised by Snyder, are: $p=1-\sqrt{O+B}$; $q=1-\sqrt{O+A}$; $r=\sqrt{O}$; O, A, and B are the percentages. $p+q+r=1$. Simply put, the group percentages represent the proportions of the phenotypes, while p, q, and r represent the proportions of the genes.

As an implement for the anthropologists, however, this branch of medicine is at present proving a disappointment. In the first place, the genetical constitution and mechanics of the whole question are far from being completely comprehended. At first it was believed that the two factors each comprised a pair of genes, one dominant and the other recessive. However, mathematical analysis of percentage distributions of the groups revealed discrepancies which led to the offering of the theory that the blood types are inherited as triple allelomorphs, the factors A and B both being dominant to the same recessive, O or R (Snyder). It is on this basis that the formulae for p, q, and r were constructed.

Lately it has been found that the A factor is susceptible of being divided into two sub-factors which react with different intensity to test sera. It is now held by O. Thomsen (1932) that these two sub-factors are actually separable, that the combination is not one of three allelomorphs but of four, and that there are not four blood groups but six. Moreover, further complexities in their inheritance arise from the fact that there appear to be different relative "strengths of dominance" between the three dominant factors, A_1, A_2, and B, the last being the

most self-assertive, and A_2 the least so (Thomsen, 1929). If this last theory is correct, it becomes clear that the results of inbreeding in a group into which all the factors have been introduced can hardly be predicted.

This assumption seems to be borne out by observations. The genetical explanation which once seemed satisfactorily simple and rigid now appears to be in danger of collapse; likewise the tractability with which it formerly seemed that the races of the world would pigeon-hole themselves in the matter of blood-types has vanished. Several years ago Snyder constructed a graph on which he plotted racial groups according to their values of p and q, dividing it arbitrarily into squares with boundaries at intervals of 5 per cent. All groups which had been typed up to that time were placed thereon and by lumping adjoining squares he divided the whole into seven classes, to which he gave names. Since that time, however, it has become difficult to fit new data into such a scheme. Parr (1931) reprinted Snyder's chart, adding data which had accrued in the meanwhile, but abandoning the effort to delimit "classes." It has developed that several samples of the same population will show widely differing blood group patterns. For a specific example let us take the Ainu. According to Parr's chart, in some samples the value of p is double or more that of q, and in other samples the reverse is the case. The only attribute which all samples have in common is a fairly high incidence of both p and q. Another instance is Micronesia, as exemplified by Takasaki's data (Steffan and Wellisch) consisting of twelve samples, most of them from the Caroline Islands, which range in size from 42 to 545 individuals. The more important of these figures I quote here.

	N	O	A	B	AB	P	Q	R
Sonsol, Pelew	57	33.3	66.7	0.0	0.0	42.3	0.0	57.7
Truk, Carolines	485	28.7	32.0	33.0	6.4	21.5	22.1	53.6
Total Micronesia[1]	12 samples	50–55	30	14	3–4	17–18	10	70
Total Micronesia[2]	2259	47.9	30.4	18.0	3.7	18.8	11.5	69.2

Here in the Sonsol sample, the observer found no trace of the B factor; yet this could hardly be a technical mistake, since he found it in every other sample. In the group from Truk he found more B than A. These two are the extreme examples, though most of the others fluctuate considerably. Nevertheless, a majority is encompassed within not too distant limits, for eight out of twelve would fall into four adjacent squares on Snyder's chart.

[1]Estimated by present author from Takasaki's twelve samples, without weighting.
[2]Calculated by Furuhata for above series, except Saipan.

This dull digression furnishes some ground for generalizations. The figures, all by the same investigator, and presumably obtained by the same technique, well illustrate the lack of a common direction of development of the blood groups among different parts of a racial group. This is due, I believe, not to the hazards of sampling, but, as was said before, to the effects of inbreeding on this particular character. Moreover, it is seen that the blood group pattern of a people can only be determined from huge samples comprising all geographical sections; only on this basis can a classification like Snyder's be put to use, should it be desirable. In other words, blood typing is not of the nature of ordinary anthropometric data, and can only be adduced as anthropological material with the greatest of critical care.

TABLE 28

BLOOD GROUP DISTRIBUTIONS IN THE PACIFIC

	No.	O	A	B	AB	P	Q	R
Hawaiians (Nigg)	413	36.5	60.8	2.2	.05	37.8	1.4	60.4
Samoans in Hawaii (Nigg)	38	38.8	28.9	26.3	5.2	19.3	17.7	62.3
Samoa (Nigg)	51	41.1	37.3	13.7	7.9	26.0	11.5	64.1
Maori (Phillips)	200	47.5	39.5	1.0	12.0	30.4	6.7	68.9
Fiji	160	43.8	43.1	9.4	3.8	27.1	6.8	66.1
Solomons	107	49.5	31.8	16.8	1.9	18.5	9.8	70.4
New Guinea	59	42.4	39.0	13.6	5.1	25.2	9.8	65.1
Territory of New Guinea (Heydon and Murphy)	753	53.7	26.8	16.3	3.2	16.4	10.3	73.3
Central and South Australia (Cleland)	355	43.4	56.6	0.0	0.0	34.1	0.0	65.9
Micronesia (Steffan and Wellisch)	2259	47.9	30.4	18.0	3.7	18.8	11.5	69.2
Japan (Steffan and Wellisch)	29480	30.9	37.6	21.8	9.7	27.4	17.2	55.6
Ainu (Steffan and Wellisch) variable, high in both, generally more B than A								
Filipinos (Steffan and Wellisch) variable, medium in both, more B than A								
Negritoes, P. I. (Grove)	297	48.5	33.3	14.1	4.0	20.9	9.6	69.6
Sumatra (Steffan and Wellisch)	546	43.7	23.0	29.0	4.3	14.8	18.4	66.1
Annam (Steffan and Wellisch)	500	42.0	22.4	28.4	7.2	10.1	19.8	64.8
Celebes (Steffan and Wellisch)	195	28.7	29.7	30.8	10.8	22.9	23.6	53.6

In the foregoing table are listed all the available data for the eastern Pacific, and representative groups for the fringe of Asia.

No definite idea as to Polynesia as a whole can be formed. The Hawaiians are very strong in A and nearly lack B; both samples of Samoans, however, have a relatively large amount of B. The Maori are fairly strong in A and weak in B, and the Fijians match them closely. On the other side, Fiji is close to the tribes of the northeast coast of New

Guinea, though these exhibit a greater amount of B. These latter, however, are rather closer in their resemblance to Samoa. An entirely separate group is formed by the Solomons, Micronesia, and the second New Guinea series (which was obtained at Rabaul, New Britain, and probably includes natives from the entire Bismarck Archipelago), these being lower in proportions of A and higher in B than the rest, and vaguely resembling only the Hawaiian Samoans.

A large sample from Australia exhibits no B at all.

Moving toward Asia, we find a close fit for the Solomons in the Negritoes of the Philippines. The Japanese (who are fairly homogeneous in their percentages) suggest the Fiji-Maori group, with an amount of q added at the expense of r. Ainus, Filipinos, and Indonesians have slightly more B than A, of which there is less than average, except among the Ainus.

To recapitulate: 1, Hawaii and Australia stand together, very high in A, lacking or almost lacking B; 2, A second group, high in A, low in B, joins hands in the following order: Maori, Fiji, Northeast New Guinea, Samoa; 3, A third group, considerably lower than the foregoing in A, and somewhat higher in B, comprises the Solomons, New Guinea and the Bismarck Archipelago, and Micronesia, and somewhat resembles the Philippine Negritoes.

RELATION OF BLOOD TYPES TO ANTHROPOMETRIC DATA

Recently there have been several attempts to demonstrate a relationship between blood types and such standard anthropological criteria as the color of the hair and eyes, and the indices of the head, face, and nose; unsuccessful attempts in the opinion of the writer. Steffan and others in the *Zeitschrift für Rassenphysiologie* (1929–1932) have been presenting the results of large scale blood-grouping carried out in certain districts of Germany. Tables and graphs, offered without comment, showing the distribution of the above criteria by blood groups, reveal no constant tendency whatever, in any character; what divergent groups there are appear to be caused by the use of small samples, and in all large samples the graphs of the four groups tend to assume the same form. Petrow likewise offers percentage tables for pigment distribution and coefficients of correlation between the above indices and the blood groups for several Central European groups. Again the groups exhibit but slight differences and no constant trends in percentages, and the correlation coefficients are trivial. However, for some dozen groups in the U. S. S. R. he arrives at a satisfactorily large coefficient, revealing

a connection between group A and dolichocephaly in the following manner. A table is given, showing the difference from the mean of each group of people, of the mean of each blood group within that group, and the coefficient is found of correlation between these differences and the sizes of the A and B groups. I am not convinced, however, that this method is valid, since the great majority of the differences are quite insignificant, and the few which are as high as half an index point may therefore easily produce a high coefficient. Semenowa, Masajew, and Kalinina, working on five districts of Russia, have made attempts along the same line, concluding that a relationship exists between blood groups and pigmentation. This the writer was unable to see. In the endeavor to relate indices to agglutinogens, they find and acknowledge the same difficulty in getting a significant direct correlation. Therefore each geographical group was divided for the cephalic and facial indices into three parts, high, low, and medium, the limits being twice the standard deviation from the mean. These sub-groups were compared with regard to blood type, and in one district there was apparent a marked affinity between the A group and long faces. This was not to be seen, however, in the other four districts.

Statistics are, like fire, excellent servants, but dangerous masters. No conclusive evidence of linkage between a blood group or factor and any somatological characteristic has yet been brought forth. Certainly the present material offered no support of such a possibility, though it must be confessed that the writer did not resort to the bloodhound tactics of the authors referred to above. Not that it might be expected that a connection between the A element and dolichocephaly discovered in Europe would hold for Melanesia; the contingency that such a linkage could exist at all is what is important, as shedding light on the mechanics of heredity or as a means of diagnosing the racial components of a population.

In the present study, the adult males of both the Fiji and Solomons series were divided into blood type groups, and means, standard deviations, and probable errors were calculated for all measurements and indices, except in the case of the two AB groups, which were too small to admit of statistical handling. In the case of each character, the difference between each pair of means was found, as well as the probable error of that difference.[1] Now, according to Charles Goring, when the differences between two groups are due solely to sampling—that is, when those groups may be considered as merely two random samples drawn from the

[1] $PE\ (M_1-M_2) = \sqrt{(PEM_1)^2+(PEM_2)^2}$.

same population—these differences will be smaller in size than their probable errors in 50 per cent of cases, less than twice their errors in 82 per cent, less than three times in 96 per cent; only 7 times in 1000 will they exceed four times, and only 7 times in 10,000 will they exceed five times. Hence, each difference was divided by its error, and these multiples of the probable errors are presented in the table and referred to as "XPE'S." These figures have no absolute meaning at all; they are merely indices, so to speak, of statistical significance.

The second table gives the summarized results of the differences between the O, A, and B groups for thirteen measurements, and lower down the totals for all differences in each archipelago. There are also supplied the number to be expected for each column on the basis of thirteen and thirty-nine characters.

TABLE 29

XPE'S (DIFFERENCE OF BLOOD GROUP MEANS ÷ PROBABLE ERROR OF DIFFERENCE)

	Fiji			Solomons			
	A and B	A and O	B and O	A and B	A and O	B and O	Fiji and Solomons
Stature	.80	.77	.33	1.11	1.28	.07	17.18
Sitting Height	.62	.39	.81	.77	.81	.12	14.36
Head Length	.54	1.57	2.41	.99	.06	.92	.56
Head Breadth	.10	.62	.54	.14	.63	.45	17.19
Bizygomatic Diameter	1.73	.16	1.26	.21	1.55	.78	12.20
Face Height	1.40	.58	1.71	.68	.51	.41	5.71
Nose Height	.22	.08	.14	.73	1.52	.20	7.11
Nose Breadth	.65	.00	.68	.76	3.06	1.68	5.89
Indices							
Relative Sitting Height	.92	1.88	.30	1.16	1.00	.28	2.79
Cephalic	.74	.13	.90	1.54	1.05	.76	11.85
Cephalo-Facial	1.66	.35	1.48	.03	2.20	1.21	4.76
Facial	1.49	.97	1.98	2.00	.64	2.49	.36
Nasal	1.50	.91	.93	2.67	1.59	1.77	2.02

TABLE 30

DISTRIBUTION OF XPE'S

	0–1	1–2	2–3	3–4	Mean
Normal	6.50	4.16	1.82	.43	1.23
Fiji					
A and B	8	5	0	0	.95
A and O	11	2	0	0	.65
B and O	8	4	1	0	1.04

TABLE 30 (*Continued*)

DISTRIBUTION OF XPE'S

Solomons					
A and B	8	3	2	0	.98
A and O	5	6	1	1	1.22
B and O	9	3	1	0	.86
Totals					
Normal	19.50	12.48	5.46	1.29	1.23
Fiji	27	11	1	0	.88
Solomons	22	12	4	1	1.02

Little comment is called for. The only remarkable feature is the fact that the differences are so much less than the expected dispersal. From this point of view the Fijians cause more surprise than the Solomonese. The present material, then, lends no support to the theory that any general morphological distinction between blood groups may be found. Of the single characters, the one which arrests attention is the facial index, the same which has been supposed, in works already described, to vary in relation to the A blood group. However, it is seen that it is the B group which is responsible for the large differences, and this is in each case the smallest in size, and liable to vary under the influence of a single individual. The nasal index, too, appears to display significant differences, though actually only among the Solomons. This is a particularly variable characteristic, though its variability should be corrected by the probable error. There is no consistency as between Fiji and the Solomons, however; both faces and noses are longest in the B group in Fiji, shortest and widest in the B group in the Solomons.

Percentage tables for observational data on the soft parts yield a little information, though it must be borne in mind that the small size of the groups, particularly that of the B factor, undeniably plays tricks. In skin color, both forehead and arm, the Fijian B group tends to be darker, with nothing to choose between the other two. The form of the hair reveals nothing. The same group has thicker integumental lips, but in the Solomon Islands it is the A group which acts similarly. No other character exhibits trustworthy differences between the groups.

Doctor Carleton Coon, in his work on the tribes of the Rif, attacked the question by the same method. In this table it is seen that Doctor Coon was likewise unable to differentiate blood groups by bodily measurements.

Riffians—24 characters

	0–1	1–2	2–3	3–4	Mean
Normal	12	7.68	3.36	.79	1.23
A–O	13	9	2	0	.99
O–B	11	12	1	0	1.05
A–B	14	4	6	0	.94

In this case it is only the nasal index which appears to vary significantly between groups, and

cannot fail to indicate some difference in racial values which on the whole is obscured by the mechanism of blood group inheritance, whatever it may be.[1]

This may well be, but the fact aggravates my notion that the probable error does not sufficiently correct this highly variable index.

Contingencies between the blood groups and nineteen observations are also supplied by Doctor Coon. The highest of these, that for lambdoid flattening, is .26; most of them range between .14 and .18 and are not significant. I believe with Doctor Coon that what tendencies toward association there are, are due to geographical contrasts in both blood type and morphological type, which is very different from the idea that a blood factor and any somatic character may link themselves within a single group.[2]

CONCLUSIONS

That a great deal regarding racial history is to be learned from the distribution of the blood groups, provided the clues are correctly interpreted, is obvious. The patent facts that American Indians were aboriginally lacking in both factors (Snyder), and that the Australians had the A factor but not the B, speak volumes. The deplorable aspects of the situation are the haziness of the superficial outlines of the problem, the mass of contradictory data, and difficulty in fixing upon what is important.

It is to be noted that in the few cases that have been listed which nearly or entirely lack the B factor and have the A factor, the latter rises to a very high percentage. Hawaii, where the B and AB classes in a good-sized sample total 2.7 per cent together, has 61 per cent of group A. Sonsol in the Pelews, and Cleland's Australians, lacking B altogether, have group A percentages of 67 per cent and 57 per cent, respectively. The explanation must be that the B factor, even in moderate amounts, tends to repress the A factor in some way, perhaps simply by elbowing it out of possible zygotic berths. Assuming such an influence to exist, there is nothing extraordinary in the high frequency of A in the three

[1] Coon, 399.

[2] Coon finds much higher contingencies when working on a single sub-group, the Senhaja. However, an examination of the tables makes it obvious that these high values are due solely to the small number of individuals involved, a peculiarity of this coefficient. Further, he finds that the tendencies observed for the total group are contradicted.

groups cited, and there is every reason to believe that they represent remnant samples of the blood type pattern existing throughout the Pacific before the introduction of the B factor.

The first mutation must have been that of the A factor, in view of the above probability and its universality outside of America. It must have originated only after the migrations to America had ceased, and probably before the population of Australia was finally formed. (This last looks like a large pill, but the data so prescribe). A is highly developed in Europe; on the whole, one is led to accept a fairly great age for this factor. The beginnings of B, however, I do not believe to be comparably remote; I am inclined to think that it is mere centuries old, rather than millenia. The Gypsies of Europe still present the blood type appearance of their Indian homeland, which indicates that in this area at least there has been no great change in group proportions since the fifteenth century. South Central Asia and India may be taken as the birthplace and breeding ground for the factor, whence it was probably spread through Indonesia to the Philippines along with Hindu influence in the first millenium A.D. and filtered into Europe with Oriental trade a short time later. Only in Hungary is there a large amount of B; it would be difficult to say which invasion provided it, although it was probably not the Turks, who have less of B than the Hungarians.

In the Pacific Ocean we may consider that the migrations of the Polynesians, in the dawn of the Christian era, took place before the B mutation had arisen, or at any rate had left its original center. For if the Melanesians, or any other Pacific people, had the B factor at the time, it could hardly have come to them through or past the original homeland of the Polynesians without sowing itself among the latter. Therefore, though it may have been carried direct into Melanesia at a subsequent date, I believe that it reached Polynesia only by diffusion.

As a postscript, this important fact should be noted. In his Maori sample, Phillips found all his AB individuals and one of the two B individuals in a single tribe, Te Arawa of the North Island. Thus, among 73 representatives of all the other tribes, all were O and A except one, who was B; this is reminiscent of Hawaii. From this single tribe, however, the sample, numbering 127, gives us an unheard-of distribution; over 20 per cent of the AB class and less than 1 per cent of the B class. Phillips explains this by suggesting that the large AB group here is the result of the mingling of the Maori and the Maoriri (Moriori?), their traditional predecessors, who, he supposes, possessed the B factor. I doubt whether such a possibility could explain the mysterious relative proportions of the B and AB groups.

GENERAL CONCLUSIONS

On the basis of the present material, conclusions reached by one who has not studied its subjects at first hand must be taken as conjectural. A final analysis must take cognizance of three dimensions and reveal stratigraphical as well as regional distinctions; this is not possible here, and each geographical group must be accepted as a unit.

It is noticed that in several measurements (stature, head length and breadth, and face width) the Fijians stand actually among the Polynesian groups, rather than below them, on the Melanesian side. This is true also of the cephalic index. Now, there appears in the measurements a distinct tendency for Hawaii and the Society Islands on the one hand and Tonga and Samoa on the other to pair themselves off metrically, the latter pair being taller and more dolichocephalic, with longer faces. In stature and head measurements it is this pair which the Fijians approximate and which seems on the whole most closely related. (In face length and the nose diameters, as we have shown, the Fijians are intermediate between Polynesians and Melanesians, or among the latter.) In spite of certain cultural associations between Fiji and New Zealand, the Maori do not meet the requirements of parenthood on several counts. For example, we must assume that the Melanesian ancestors of the Fijians had a lower head breadth and index than the Fijians; descendants of these and the Maori would hardly have a greater width and index than either parent. On the other hand, we may readily look on the narrow-nosed Maori as possible progenitors of the inhabitants of Tanna and Eromanga.

Let us leave these questions in abeyance and turn to the Solomon Islands. To these it is difficult to assign an exact status on the basis of physical measurements. In their central position, it is probable that they have suffered more than their share of invading groups differing in physical type.

It is possible to assume that formerly the Solomons more closely resembled Santa Cruz, as represented by Speiser's sample, having broader and more squat noses and faces, and were subsequently influenced by incursions from the region of New Guinea (and perhaps to a slight extent from Polynesia. It must be remembered that our series is almost entirely from the eastern end of the islands). Where the Bismarck Archipelago fits in cannot be said, for the Baining and the Namatanai district do not tell the whole story, even though the likeness between them is considerable; it can only be said that there is a definite difference between them and other Melanesians.

It should be remarked also that there is a general resemblance between Santa Cruz and New Caledonia. The people of the latter are taller with larger heads, but the cephalic index is the same, the face is wide and short, and the nose very broad. Professor Dixon (1923), in his analysis of the distribution of cranial types, states it as his belief that the first settlers in the smaller Melanesian islands were his Proto-Australoids and Proto-Negroids, or long-headed platyrrhine people. He did not use the facial index as a factor in segregation; nevertheless a short, wide-flaring face on a long head is characteristic not only of true Australians but of what are generally considered to be the earliest and most primitive types in Melanesia. Thus we may take such a face as a stigma of a low stratum and give it as an additional attribute to Doctor Dixon's Proto-Australoids and Proto-Negroids. If these speculations are near the mark, our first assumption is probably correct and fits Doctor Dixon's theorizing well. (He finds brachycephalic cranial types only in New Britain and New Ireland and the Central Solomons.) Therefore we have a basal stratum common to the Solomons, Santa Cruz (and the New Hebrides?) and New Caledonia, upon which was grafted in the Solomons a stock or stocks which differed mainly in having narrower, longer faces.

Whether this primeval stratum extended to Fiji is a question. The natives have been reported by many observers as more and more Melanesian in appearance as one goes west, though the Polynesian element throughout the group has been minimized generally. Our sample however, is revealed as being metrically more Polynesian than Melanesian, though the measurements are belied by the hair and the skin color. This is perhaps explicable by the suggestion that if the Polynesian strain contained a negroid element, the appearance of the Fijian hybrid would be strongly impelled towards the negroid side, though actual measurements would not so react and would give a more exact account of the proportions in the mixture.

In seeking to reconstruct the story of the original coming of the Polynesians, we must delve reservedly into the subject of Polynesian migrations. Fornander in 1878, from a study of genealogy and tradition, laid the groundplan for their history, which has been accepted almost unchanged ever since. The Polynesians, a pre-Malay people, left Indonesia under pressure of invasion by two routes in the second century A.D., the two groups meeting in Fiji. After a sojourn of considerable length, marred by bickering with the black indigenes, who absorbed much of Polynesian language and myth, the travelers departed eastward. Each of the island groups of Polynesia having been populated, there was a

long period of isolation and peace. Suddenly, for an unknown cause, wholesale migrations, originating in central Polynesia, brought the peripheral groups again into the family circle; this resurgence of maritime enthusiasm lasted from the eleventh to the fifteenth centuries, when it again subsided. Churchill suggested that there was a second Polynesian immigration from Indonesia, which he calls the "Tongafiti" people, about a thousand years after the first; this would be responsible for the eleventh century upheaval and might have brought the strong Mongoloid strain of Tonga and Samoa, which contrasts with the Caucasoid type of the older stratum.

At any rate, both authors deposit the Polynesians on Fiji on their journey eastward. Another school holds that the Polynesian in Fiji is entirely the result of an infiltration westward, coming directly from the groups responsible. Thomson (1908) believes that this alien blood is mainly from Tonga, since in historic times Tongans made yearly trips to Fiji as part of a gentleman's education, although in any case the eleventh century wanderings would have brought many shipwrecks to Fiji. He objects to the idea of the Fijian period in Fornander's plan, pointing out that the evidence of Polynesian mythology in Fiji on which it is based does not exist.

Fornander has more recently been supported by Hocart (1919, 1929), who proposes that all of Fiji was once occupied by Polynesians, with the exception of the hills of Viti Levu, whence the rude Melanesians erupted, spreading eastward and causing an exodus of the Polynesian tenants to Samoa and Tonga. These movements are traced by traditions of their former homes, among various Fijian tribes, and are further based upon linguistic and ethnographic evidence much like Fornander's. For example, in Samoa there exists much tradition concerning Fiji, with names of gods and chiefs, while Fiji generally is ignorant of Samoa. The Samoans declare that they learned mat-making from Fiji, though today they make better mats than the Fijians, indicating that both may have learned the art from people who left Fiji and went to Samoa. Furthermore, certain Polynesian words in the Lau islands are neither Tongan nor Samoan.

This last theory seems close to the truth. A large volume of Polynesian infiltration would be required to produce such a type as our sample represents, and the evidence, leaving aside somatology, all points toward movements eastward rather than westward. It differs from Fornander's ideas only in supposing the major part of Fiji to have been held by Polynesians until recently, and explains the state of affairs with regard to

place names and myths equally well. However, the beginning of these movements is dated at only nine generations ago, and it would have been difficult for the western hill tribes to convert an entire archipelago to a preponderantly Melanesian speech and culture, while not succeeding by half in converting their physical type. There is another possibility, which takes us further back in history, and furnishes a stronger impulse.

It is possible that before the eleventh century Fiji was entirely Polynesian (of the Tonga-Samoa type), or that, if the hill tribes were present on Viti Levu, they were inactive. It may be suggested that the wave of longer-faced, narrower-nosed people which struck the Solomons (as postulated above) carried on to Fiji. There are Fijian traditions of an arrival at Vunda, on the northwest coast of Viti Levu (Thomson). The newcomers, taking possession of the archipelago, partly amalgamated with and partly pushed out the Polynesian tenants, just as did the hill tribes of Hocart's theory, the refugees fleeing to Samoa and Tonga. Their arrival there might have been responsible in turn for the eleventh century migrations outward from this area (to which some potent cause should certainly be assigned) and responsible for the stronger negroid strain of Samoa and Tonga. The whole process is that of a row of blocks. In this case the Mongoloid strain of Tonga and Samoa may be due, in Fornander's scheme, to the probability that these were the last emigrants from Indonesia in the second century and had acquired the strain from the Malay invaders who drove them out. Thus Churchill's "Tongafiti" people, whom he can detect as a stratum in Polynesia, but cannot trace at all through Melanesia, become simply an excursion from the Fiji-Tonga-Samoa region of the local culture, which had specialized in the long period of isolation.

The above plan, which is only a suggestion, may be refutable on ethnological grounds. It is an attempt to explain some of the more obvious features of the data, such as the strongly Polynesian nature of the Fijians and the negroid strain of Samoa and Tonga. It may be that Fornander was more nearly correct; at any rate it seems necessary to postulate some kind of wholesale importation of Polynesians into Fiji.

The information furnished by the blood groups is meager. If our notions are correct, however, we have conclusive proof that to Samoa there has come a later intrusion (whether primary or secondary) bringing the B factor, which did not reach Hawaii. It is possible that Samoa and Hawaii represent the central and peripheral areas generally in this respect, for the Maori have relatively little of the B. It is present in moderate amounts in the Solomons and Fiji; in the latter less so than in

Samoa. How the factor obtained its distribution in the last two places there is no telling; it may have arrived independently in both, or traveled from either to the other. One can offer the hypothesis that it was spread by a later wave of Melanesians and thus came through Fiji into Polynesia.

The Fijian problem could be more satisfactorily answered by an intensive anthropometric study and perhaps by an examination of cranial material, such as that which reposes in the Godeffroy Museum in Hamburg.

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