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TRANSACTIONS OF
THE CONNECTICUT ACADEMY
OF ARTS AND SCIENCES

VOLUME 25] APRIL 1921 [PAGES 1-92

Anthropological Studies
on the
Quichua and Machiganga Indians

BY

H. B. FERRIS, M.D.
Professor of Anatomy in Yale University.

NEW HAVEN, CONNECTICUT
PUBLISHED BY THE
CONNECTICUT ACADEMY OF ARTS AND SCIENCES
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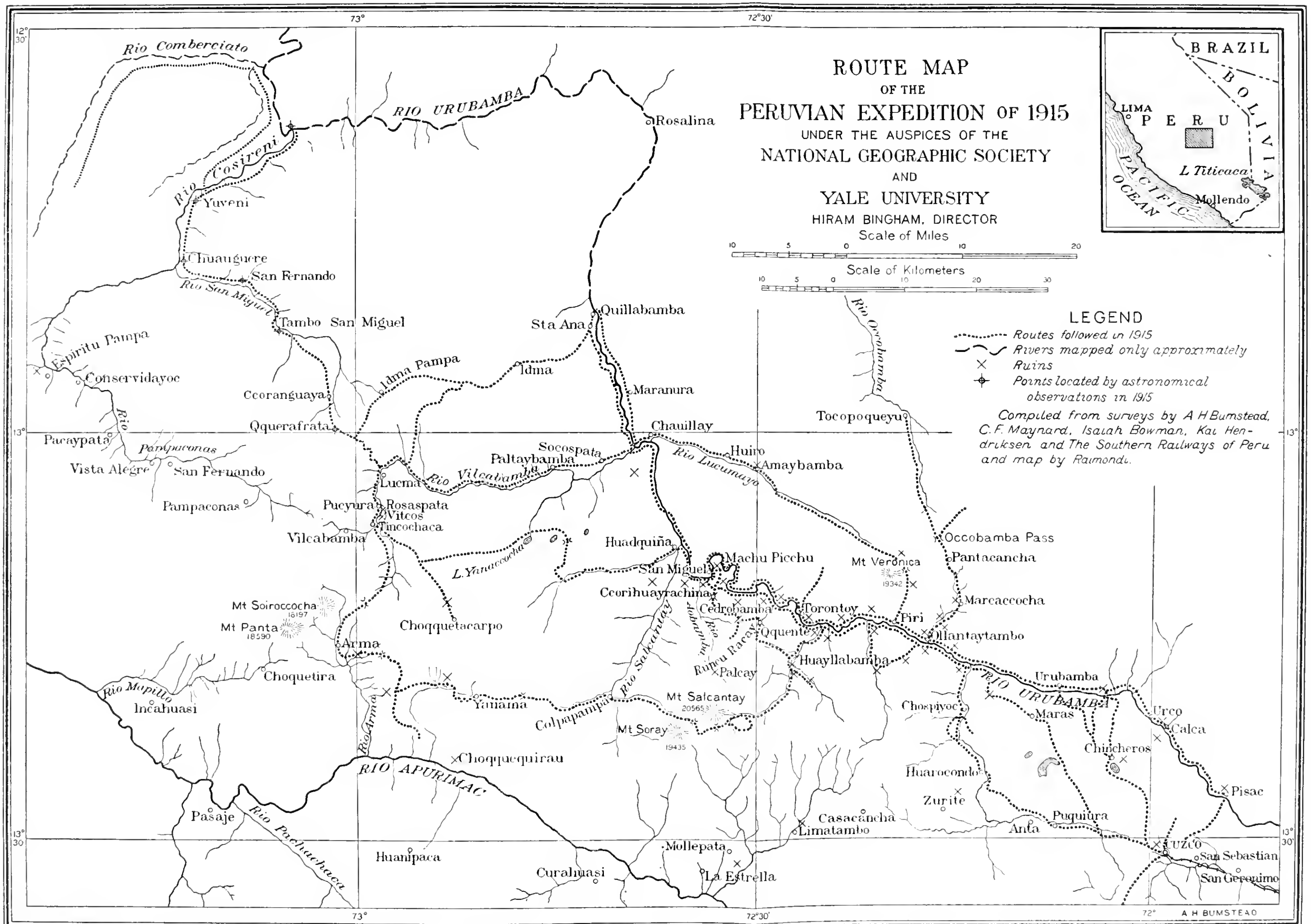
THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

MAP SHOWING THE ROUTES TAKEN BY THE EXPEDITION OF 1915 AND THE REGIONS WHERE MEASUREMENTS WERE MADE.

The Machiganga who were measured occupy the San Miguel Valley.



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INTRODUCTION.

The following study is based on data collected by Dr. D. E. Ford, surgeon of the Peruvian Expedition of 1915, which was under the auspices of the National Geographic Society and Yale University and under the direction of Prof. Hiram Bingham.

While the matter collected is in general along lines similar to those followed by the Expedition of 1912 and reported by the writer in 1916 as a Memoir of the American Anthropological Association under the title of the Indians of Cuzco and the Apurimac, the number of measurements of each individual is less and many more females are included. Forty-one different measurements were made by the Expedition of 1912 and 18 by this last expedition. Some measurements of importance were added, however. The ones omitted were principally those of the extremities and trunk as also several of the head and face. These omissions are to be regretted as some interesting facts relating to the proportions of the segments of the extremities were ascertained by the Expedition of 1912 and it was desirable to check these results by further observations.

It was the intention to measure only the pure Quichua but undoubtedly some mixed whites were included, probably, however, not to exceed 8% and therefore not separately considered in our tabulations. The criteria of purity are the skin and iris color, the lack or sparseness of beard, the straightness of hair and general physiognomy. The data were recorded according to a chart devised by Dr. Aleš Hrdlička.

The localities in which measurements were made so far as the Quichua are concerned were in a more restricted region than was the case in the former expedition and were confined to the provinces of Urubamba and Convencion of the Department of Cuzco between the parallels of latitude 13° and 13½° S. and between 72° and 73° W. longitude. Two quite different racial groups were studied, the Quichua of the Peruvian Highlands and the Machiganga Indians living in the region of the head waters of the Amazon, largely in the San Miguel Valley about 12½° South latitude and 73° West longitude. The accompanying map indicates the regions where measurements were made both in the case of the Quichua and the Machiganga. The altitude of the regions inhabited by the Quichua who were measured varied from 5000 to 10,000 feet and averaged about 8000 feet. The Machigangas live at an altitude of 3000 feet. They are considered in Part II.

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PART I.

THE INDIANS OF CUZCO.

The 153 Quichua measured, 85 males and 68 females, inhabited two provinces and thirteen localities as indicated in the following table:—

Department	Province	Locality	Male	Female	Total	
		Corpus Quicpe	1	—	1	
Cuzco	Urubamba	Higospata	7	17	24	
		Muccayoc	1	—	1	
		Ollantaytambo	22	10	32	
		Patallacta	10	2	12	
		Pucyura	7	6	13	
		Pancacancha	12	8	20	
		Rumida	9	13	22	125
	Convencion	Santa Rosa	1	—	1	
		Timcochaca	1	—	1	
		Huadquiña	—	1	1	
		Ttarayoc	2	1	3	
		Zucma	12	10	22	28
		13	85	68		153

The methods employed for ascertaining the data may be classified as (1) measurements, (2) inspection, (3) physiological, (4) photography. The instruments used were the craniometer made by Keuppel and Esser Co., New York, for measuring the face and head; small, sharp-pointed sliding calipers for nose, mouth, ear, and hand measurements; a large sliding compass with long rigid arms for chest and foot measurements; steel tape for measuring height and span and a dynamometer (Schuemann-Jones Co.) for testing hand grip. Photographs full face and profile were made in all instances; some, however, were unsuccessful.

Previous Studies of the Quichua.

There are but three records of measurements of the living Quichua, viz., d'Orbigny (2), Chervin (1), and the data obtained by the Yale-National Geographic Society Expedition of 1912 and reported by the writer (4). Forbes (5), however, studied a closely related group, the Aymara. D'Orbigny's measurements covered little more than stature but Chervin's data included twenty different measurements. There should also be mentioned a study of osteological material from Machu Picchu by George F. Eaton (3). The report of the former Yale Peruvian Expedition included a study of twenty-one measurements of the body and extremities, twenty of the head and face with the indices derived therefrom as well as observations on the eyes, teeth, skin and its appendages, deformations and anomalies. Comparisons of the results obtained from the data of the former expedition with those of the recent expedition will be considered under each topic. It is to be regretted that such comparisons cannot be made in every instance on account of the lack of some of the measurements in the data obtained by the last expedition.

Some of the tentative conclusions reached from the former study were, that the Quichua were of low stature, with broad shoulders. That in relation to stature the upper extremity was long, especially the forearm, and the lower extremity short, especially the thigh, and the *triceps surae* muscle greatly developed. The scalp hair is black and straight, the beard sparse, grayness and alopecia rare and the *panniculus adiposus* poorly developed. On the average the Quichua is mesaticephalic and generally hypsicephalic. As to physiognomy they are euryprosopic with prominent malar region, lips somewhat thick and procheilous, ear mesotic, nose with straight or slightly sinuous dorsum and divergent nostrils and mesorrhine in proportions. An average brain weight of 1265 grams estimated from cranial measurements placed the Quichua in the mesocephalic group.

Pathological Observations.

Among those measured no congenital and only two acquired malformations were observed. One of these was a deformed finger and the other the loss of the terminal phalanx of one finger. Twenty males, or 23.5%, were pockmarked, and eleven females, or 16.1%. One case of hemorrhoids and one cretin (No. 126), both females, were observed, and a single case of varicose veins of the leg. One male presented a scar near the left angle of the mandible, which was the result probably of tubercular lymph nodes, and there was one case of conjunctivitis.

one case of osteoma of the mandible in a female (No. 9), and a few instances of oriental sore. Goitres were numerous and eleven cases (12.9%) were found in the males (85) and an equal number in the females (16.1%) of the sixty-eight measured. The different lobes were affected in about equal proportion. Goitre seems to be more frequent in the neighborhood of Patallacta, where the drinking water comes directly from the glaciers, and it is the prevailing idea of the natives that goitres are produced by drinking glacier water. No exophthalmos was noticed in any of the cases.

Among the diseases which were treated by Dr. Ford are interstitial nephritis, pterygium, typhus, pneumonia, chronic colitis, pulmonary tuberculosis, rheumatism, mitral regurgitation, and oriental sore, a disease due to infection with a protozoan parasite known as the Leischman-Donovan body. The infected area was generally located on the posterior surface of the leg just above the heel, but in some instances the external ear was the region infected.

Age.

The ages of the Quichua measured varied from 18 to 49 years in the males and in the females from 15 to 60, giving an average age of 31 for the males and 28 for the females. The following table shows the number in each decade:—

	Males	Females
15-20 years	8 or 9.4 per cent	12 or 17.6 per cent
21-30 years	31 or 36.5 per cent	29 or 42.7 per cent
31-40 years	19 or 22.3 per cent	11 or 16.2 per cent
41-50 years	13 or 15.3 per cent	8 or 11.8 per cent
51-60 years	———	1 or 1.5 per cent
Ages not given	14 or 16.5 per cent	7 or 10.3 per cent
	85	68

All but a small percentage had so nearly finished growth that only a slight error is introduced by neglecting the factor of age.

Hand Pressure.

The grip strength was tested in both right and left hands in both males and females by a dynamometer (Schuemann-Jones Co.), recording pressure in kilos with the following results:—

	Males		Females	
	Right	Left	Right	Left
No. of cases	84	84	62	62
Average	24	22	11.2	9.3
Greatest	42 (149)	43 (92)	24 (91)	23 (91)
Least	5 (39)	5 (39)	2 (38)	2 (38.59)

These results can not be directly compared with those of the previous expedition because dynamometers of different makes were used, but the comparison with the grip strength of twenty white male adults of sedentary occupation with an average in the right hand of 45 and in the left of 39 shows that the forearm muscles are poorly developed in the Quichua. This agrees with the former results. The average grip for the right hand as found by Hrdlička (7) in the male N. A. Indian varied from an average of about 41.8 to 47., and for the left hand, 38 to nearly 41 for different ages, being greatest in the third decade.

In the case of the females Hrdlička found an average varying from 24.9 to 27.8 in the right hand and from 22.9 to 25.8 in the left hand in the different tribes. No tests for power of traction or the strength of other groups of muscles were made. Strength tests for the muscles of the legs would probably show the Quichua to better advantage as the development of the forearm and leg muscles are markedly different.

Pulse, Temperature and Respiration.

There are only six observations on the sublingual temperature, all on males, showing a variation from 98.4 to 98.7, with an average of 98.5°.

The pulse was counted in 85 males and 64 females, in all of whom the health seemed good. In the males the lowest pulse rate was 54 and the highest 102, with an average of 74. In the females the average rate was 78, the lowest 60, and the highest 92.

The rate of respiration was counted in 80 males and in 55 females. The average rate in the males was 17.2, the lowest 14, and the highest 21. In the females the average rate was 17.9, the lowest 14, and the highest 21. The breathing in the female was more diaphragmatic and abdominal than costal.

Number of Children.

The number of children in a family varied up to eight, the average being 2.2, which is nearly the same result (2.8) as obtained by the previous expedition. Omitting those women completely sterile, the average number of children is raised to 3.0; 26.5% of the marriages were childless, as compared with the former expedition's result of 27%, and twelve women had only one child. Girls were in the ascendancy, there being 82 girls to 61 boys, and in 9 the sex was not stated. This is in the proportion of 100 girls to 74.4 boys, in contrast to the proportion of births in the white races of 100 girls to 106 boys. Chervin states that the Quichua have 100 girls to 67 boys. It is of course recognized that these statistics are very imperfect and that it is not proper to contrast the proportion of sexes at birth in one race with the proportions living at a later period in another.

Skin and Appendages.

The color of the skin in the male was found to be medium brown in 67%, dark brown in 2.4%, and light brown in 30.6%. In the females the proportions are medium brown 63.3%, dark brown 2.9%, light brown 33.8%, a slightly larger proportion of the females having a light brown skin. There were ten cases of freckles observed, 7 females and 3 males; 20 males and 11 females were pockmarked. No naevi or tattoo marks were noticed.

In the males the scalp hair was straight in all cases and black in all except one, in which it was brown, probably a mixed white. In the females the hair was black in all instances and straight in all but one, in which the hair was slightly wavy. In the males the hair was considerably gray in four instances and slightly gray in six. The scalp hair was only slightly thin in twelve cases, no marked example of calvities was recorded. In the females the scalp hair was slightly gray in six cases and thin in two instances. Grayness does not seem to appear earlier or to be more extensive in the females than males. No mention was made as to whether the hair was fine or coarse.

So far as these results go the Quichua does not seem to entirely agree with the Aymara, who, according to Forbes, never show calvities or grayness if of pure blood. They, however, nearly accord with those of the Yale Peruvian Expedition of 1912, where only one case of slight calvities was found, in a man of 80 years, and a few gray hairs in three men, one of 45, another of 60, and a third of 80 years. One female, No. 17, had white eyelashes.

The moustache and beard were entirely absent in 38.8% of the cases, sparse in 18.8%, present to a small extent in 42.4%. The hair was straight in all but three cases, black in all instances but two, in which the beard was brown, and two mixed black and brown. Five cases showed a few gray hairs.

The observations of Hrdlička (7) show that in the North American Indian graying of the hair does not progress so rapidly as in the whites, and this is also true of the Quichua. According to the results of the same author, baldness in the Indians of the Southwest is rare, occurring to about the same extent as in the Quichua, 4.6% in males below 65 and .3% in females.

In only one instance, a female (No. 99), was the *panniculus adiposus* greatly developed.

The breasts were conical in the females without children.

Palpebral Fissures.

In the male the palpebral fissures were horizontal in 55.3% of the cases, slightly lower at the inner canthus in 44.7%. In the female they were horizontal in 57.1%, the inner canthus depressed in 41.2% and the inner canthus higher in 1.5%. The former expedition found a lower inner canthus in only 26.5%.

The Mongolian fold (epicanthus) was present in four cases, two male and two female, or 2.6%, in contrast with 15% of the males reported by the Expedition of 1912. One is inclined to question the accuracy of the observations of the 1915 Expedition on this point.

Eyes, Conjunctiva.

The eyes were grouped according to color into four classes: dark brown, medium brown, light brown and black. No attempt was made to distinguish between the areola and periphery of the iris as in the former expedition. Of the men 88.2% were found to have dark brown eyes, 1.2% light brown, 9.4% medium brown and 1.2% black. In the female 92.6% were dark brown, 1.5% were light brown and 5.9% were medium brown, indicating that the eye of the female inclines to be darker than in the male. It is impossible to compare these results with those of the previous expedition inasmuch as the iris color was classified according to the Bertillon system.

The conjunctiva in the male was yellowish in 94.1%, white in 4.7%, and in one case the color of conjunctiva could not be determined because of the presence of a conjunctivitis. In the females the proportions are somewhat different, the conjunctiva showing yellowish in 85.3% of the cases and white in 14.7%. Whether this difference constitutes a real sex character or is an indication of greater extent of racial impurity in the female the writer is unable to say.

Angle of Mandible.

In the male the angle of the lower jaw was medium in 30.6%, submedium in 16.5%, and supramedium in 52.9%.

In the female the angle in 35.3% was medium, in 5.9% submedium, and in 58.8% above medium. There were no cases of pronounced angle in either sex.

Alveolar Prognathism and Lips.

This was determined by inspection and in the males 90.6% showed a medium degree of prognathism, 9.4% a supramedium, none showed a pronounced degree.

In the case of the females 97.1% were medium in prognathism and 2.9% were supramedium. None were pronounced. Alveolar prognathism seems somewhat more marked in the female than in the male.

In the males the lips were classified as medium thick in 74.1%, above medium in 23.5%, and submedium in 2.4%. No cases were recorded as thin or very thick.

In the females 70.6% of the lips are medium, 26.5% above medium, and 2.9% submedium. Here also there were no examples of thin or very thick lips. The degree of eversion was not noted. So far as the lips are concerned there is little difference noticeable in the sexes; a slight preponderance of the supramedium lip, however, is present in the female.

Chin.

In the male Quichua the chin was found medium in prominence in 62.4% of cases, submedium in 17.6%, above medium in 20%.

In the female the chin was medium in 64.7%, submedium in 20.6%, and above medium in 14.7%. There were no cases where the projection of the chin was pronounced either in the male or female.

The only sex difference in the prominence of the chin is that the supramedium chin is somewhat more frequent in the male.

Malars.

In the male 12.9% show medium projection of the malars, 65.9% supramedium, 1.2% submedium, and 20% pronounced.

In the females 11.8% are medium in projection, 66.2% above medium, 22% pronounced, and none submedium.

The malars are therefore more prominent in the Quichua than in the white races, with little difference in the two sexes.

Forehead.

The height of the forehead is measured from the nasion to the crinion in the median line. Occasionally the hair line slopes downward as it approaches the median line. In such cases this measurement is unsatisfactory. As alopecia is a very unusual condition in the Quichua, observations on the forehead height are more satisfactory than in most races.

The average nasion-crinion height in the male is 48, the extremes are 66 and 26, and the variation range 40. In the female the average is 43, the greatest 57, the least 29, and the variation range 28. The forehead of the female Quichua is therefore less in height and the variation is not so great as in the male.

Hrdlička found the average forehead height in the natives of the Kharga Oasis to be 62, which he remarks is noticeably less than in most groups of male whites and other races exclusive of the Indian and most of the Negroes.

The seriation tables indicate well the greater range of variation and higher average found in the male.

The forehead of the Quichua according to these observations is very low and probably can be explained as in the case of the large face height determinations by the placing of the nasion too high.

The forehead height as determined by inspection shows in the males 77.4% medium, 21.4% submedium, and 1.2% supramedium; in the females the results are 70.6% medium, 28% submedium, and 1.5% supramedium. In one male the forehead is recorded as very sloping and in one as vertical. The vast majority in both sexes, however, have foreheads with medium slope, and on the average the forehead of the female seems to be lower than that of the male.

Supraorbital Ridges.

The supraorbital ridges were recorded as imperceptible, small, medium, supramedium, and pronounced. In the males 50.6% show medium developed ridges, 12.9% submedium, and 36.5% supramedium. In the females the results were 63.3% medium, 17.6% submedium, and 19.1% supramedium. The less developed supraorbital ridges in the Quichua female harmonizes with the sex difference observed in other races.

Mouth.

The mouth is measured in a straight line from one angle to the other. In the male the average width is 5.4 cm., the extremes 6.9 cm. and 4.5 cm., and the variation range 2.4 cm. In the female the average is 5.1 cm., and the extremes 6.2 cm. and 4.3 cm., with a variation range of 1.9 cm. The mouth of the female in general is smaller and shows a less range of variation than that of the male.

Racially the mouth width in the male varies from 46.9 mm. to 59. mm., and in the female from 47.2 mm. to 53.5 mm. The Quichua therefore occupy an intermediate position in respect to the size of the mouth.

The following table shows that a wide mouth in both male and female Quichua is generally associated with large features, as a broad and high face, broad nose, and also with increased age.

Stature.

Of the 79 male Quichua measured, the maximum height was (No. 132) 1825 mm., the minimum (No. 113) 1250 mm., with a range of variation of 575 mm. and an average of 1584 mm. While the maximum as here given exceeds that found by the Expedition of 1912 for the pure Quichua male (1713 mm.), and the minimum is less (1426 mm.), the average is practically the same (1583 mm.).

QUICHUA.

Relation of Width of Mouth to Breadth and Height of Face, Breadth of Nose and to Age

MALE.

15 Narrowest Mouths.					15 Widest Mouths.				
Width of mouth	Breadth of face	Height of face	Breadth of nose	Age	Width of mouth	Breadth of face	Height of face	Breadth of nose	Age
4.5	14.0	12.6	3.6	24	5.8	14.4	13.4	4.4	44
4.5	13.7	13.8	3.7	24	5.8	14.5	14.4	4.1	26
4.5	14.0	13.1	3.9	42	6.0	14.4	15.6	3.9	23
4.5	13.4	13.2	3.9	20	6.0	14.3	13.8	4.5	30
4.7	13.5	12.5	3.4	19	6.0	14.7	13.0	4.4	35
4.7	14.6	14.0	3.6	28	6.0	14.0	14.4	4.5	50
4.8	14.3	14.2	3.9	19	6.0	14.5	13.7	3.9	42
4.8	14.8	13.2	3.5	29	6.0	13.2	14.3	3.9	30
4.8	14.3	13.0	3.7	36	6.2	13.9	14.2	4.1	32
4.9	14.2	12.8	4.0	26	6.3	14.4	13.8	4.5	40
4.9	13.5	13.4	3.8	30	6.4	14.2	12.4	4.7	46
4.9	13.4	12.8	3.9	18	6.5	15.1	13.9	4.7	—
4.9	13.5	13.5	3.9	30	6.6	14.3	14.3	4.2	39
4.9	13.3	12.0	4.0	19	6.8	14.3	13.0	4.4	22
4.9	14.6	12.8	3.9	34	6.9	15.2	14.3	4.7	—
Average:									
4.7	13.9	13.2	3.8	26	6.2	14.4	13.9	4.3	35

FEMALE.

15 Narrowest Mouths.					15 Widest Mouths.				
Width of mouth	Breadth of face	Height of face	Breadth of nose	Age	Width of mouth	Breadth of face	Height of face	Breadth of nose	Age
4.3	12.6	11.2	3.3	22	5.6	13.6	12.0	4.3	32
4.3	13.6	12.3	3.7	18	5.6	13.5	12.0	3.9	28
4.4	13.3	13.1	3.6	18	5.6	13.1	13.4	3.8	26
4.4	14.2	12.3	4.1	32	5.6	13.2	12.8	3.5	32
4.5	13.8	12.0	3.4	—	5.6	12.7	12.6	3.8	45
4.6	13.7	12.6	4.1	22	5.6	13.7	13.4	3.1	25
4.6	13.7	13.4	3.1	25	5.7	13.3	12.4	3.6	25
4.6	13.0	12.5	3.6	34	5.7	13.1	13.4	3.7	42
4.6	14.1	14.1	3.8	22	5.8	13.3	14.1	3.5	47
4.7	13.1	11.9	3.8	20	5.8	14.2	14.0	3.7	23
4.7	13.0	13.3	3.4	20	5.9	14.9	12.8	3.2	25
4.7	13.2	12.3	3.5	22	5.9	13.7	13.9	3.5	38
4.7	13.5	12.2	3.4	16	6.0	13.3	13.8	4.0	50
4.7	12.7	12.6	3.8	45	6.0	14.1	14.1	3.8	22
4.7	13.4	12.2	3.7	25	6.4	13.5	14.8	4.0	27
Average:									
4.6	13.4	12.5	3.6	25	5.8	13.5	13.3	3.7	32

In the 65 females measured, the greatest height is 1681 mm. and the least 1250 mm., with a variation range of 431 mm. and an average of 1454.

The average male stature of 1584 mm. places the Quichua in Topinard's "low stature" group (below 1600 mm.). The average male is 130 mm. taller than the average female, which is approximately the same difference that exists in the sexes in other races.

The following table exhibits the average height of the Quichua as obtained by different observers:—

	Stature Male	Stature Female	Author
Quichua	1600	——	d'Orbigny
Quichua	1580	1540.5	Chervin
Quichua	1583	1426 (1)	Yale-Nat. Geog. Exp. of 1912
Quichua	1584	1454	Yale-Nat. Geog. Exp. of 1915

It is evident that the stature of the Quichua is quite similar to that of the Labrador Eskimo as given by Boas (1575) and by Duckworth (1577), and these constitute the two best-known short stature races on the American continent.

The average height of a tall race, as the English, is given by Pearson as 1728 mm.

At the end of the article will be found tables of the various measurements and the indices derived from them as also the seriation tables.

A perusal of the seriation table of stature shows that 45, or 59.3% of the Quichua males belong to Topinard's "low stature" group, while 6, or 7.6%, belong to his "high stature" group, and 28, or 33.1%, to the "medium group."

The maximum reach or span was not measured for either the male or female Quichua and therefore the relation of span to stature can not be determined. The average span for the male, as determined by the Expedition of 1912, was 1621 mm., and the average span-stature index $\left(\frac{\text{span} \times 100}{\text{stature}}\right)$ was 102.3. The index is therefore nearly the same as in the Mongolian races generally and less than in the white races.

Sitting Height.

The sitting height was measured in 80 males and 68 females. In the males the average was 830 mm., the extremes 941 mm. and 641 mm., and the variation range 300 mm.

In the female the average was 804 mm. and the extremes 890 mm. and 698 mm., with a variation range of 192 mm. This shows a greater constancy of body length in the female. Also as the stature variation is greater in both series than in the case of the sitting height, variation in stature in both sexes is due more to variation in the length of the lower extremities than to variations of the body length.

The Expedition of 1912 found the average sitting height in the male to be 836 mm. with a variation of 184 mm., which is also in close agreement with Chervin's results (840 mm.) as well as those of the present report with the exception that his range of variation was less (114 mm.) than that obtained by the former Expedition and slightly greater than the result obtained by this Expedition (830 mm.). The body height of the Quichua male, then, is a little greater than that of the Labrador Eskimo (810 mm., Duckworth) and considerably less than the average in the English male (905 mm.). The average body height of the Quichua female (804 mm.) is less than that of the male but not relatively to the stature.

The seriation table shows that while 63.7% of the males in body height are between 819 mm. and 879 mm., only 48.5% of the females are included in these limits.

Sitting Height Index.

The relation of the body height to the stature is indicated by the height sitting-stature index. In the Quichua male this averages 52.5 with a variation range of 34.4 and extremes of 70.0 and 35.6. Chervin (67 cases) found that the greatest index was 56.24, and the least 48.25, the variation 7.99 with an average of 52.95. The average according to the results of the 1912 Expedition was 51.6. This index is low (46.5) in the native Australians and high (54.8) in the Ainos and quite similar to the Quichua in the Shoshoni (52.2) and certain Eskimo (52.5). A high index represents largely the persistence of an infantile characteristic, viz., relatively short lower extremities.

In the case of the Quichua female the average index is 55.6, the extremes 79.3 and 48.6, with a variation range of 21.7. It is thus seen that the average index is distinctly higher in the female and the variation range less. Chervin gives this index as 53.7 (7 cases).

A review of the seriation tables shows that 67.1% of the males have an index between 51.9 and 54.9, while in the case of the females only 48.4% are within these limits.

Hand Measurements.

The left hand was measured in 85 males and 68 females. The length of the hand is the distance, when in line with the forearm and the fingers extended, from the mid point of a line connecting the proximal borders of the thenar and hypothenar eminences to the distal end of the longest digit, which in nearly all instances is the third.

The breadth of the hand was measured from the point of intersection of the thumb and a line extended from the radial border of the index finger to the mid point on the ulnar side of the hand between the flexion groove of the little finger and the line tangent to the proximal ends of the thenar and hypothenar eminences.

In the Expedition of 1912 the hand length was measured from the interstyloid line to the end of the middle finger. It is admittedly difficult to quickly and accurately determine the interstyloid line, but the measurement so obtained corresponds more nearly with the hand length as determined on the skeleton. In other words, the hand length as determined on the palmar surface from the thenar-hypothenar tangential line does not include the upper part of the carpus. The writer would judge from a few observations on this point that the hand is about one centimeter longer as determined by using the interstyloid line than by using the thenar-hypothenar tangential line. He is inclined to the belief that inasmuch as the dorsal edge of the distal extremity of the radius can be felt, that it should be used rather than the interstyloid or thenar-hypothenar line. This would increase the length of the hand probably by about two millimeters as compared with the interstyloid line length. Perhaps, however, one objection to this method of measuring the hand length is the fact that the length of the forearm is measured to the styloid process of the radius as the lower point. The breadth of the hand was not determined in the Expedition of 1912. If comparisons are to be of any value whatever, similar methods of measurements of the living should be adopted by anthropologists and these methods should be such as to give results as closely as possible to the measurements obtained on the skeleton. The physiognomic measurements of the nose, however, clearly can not be compared with those of the skeleton.

In the male the average hand length is 171, the extremes 188 and 149, and the variation range 39. In the former expedition the average was 174, the extremes 197 and 156, and the range of variation 41.

In the female the average hand length is 159, the extremes 174 and 144, with a variation range of 30. The average male hand surpasses in length the average female hand by 12 millimeters. The only female hand length obtained by the 1912 Expedition was 163.

The average breadth of hand in the male is 88, the extremes 97 and 76, and the variation range 21. In the female the average breadth is 77.5, the extremes 86 and 67, and the variation range 19.

Martin gives 184 as the average hand length of the European.

The hand index $\left(\frac{\text{width x 100}}{\text{length}}\right)$ in the male averages 51.3, the extremes are 56.4 and 45.4, and the variation range 11. In the female the average index is 48.8, the extremes 53.4 and 44.2, with a variation range of 9.2.

Martin states that this index varies racially from 40 to 48.1, being less in the female. Comparison of the results of different observers are well nigh impossible, because of the different methods of measurement employed.

The seriation tables dealing with the measurements of the hand show that while 50% of females have a hand length between 15.6 and 16.6, the males have only 18.8%. Of the females, 88% have hand breadths between 7.4 and 8.4, while only 11.7% of the males are within these limits. The male, apparently, is more variable in both hand breadth and length than the female. Similarly, in the case of the hand index, the males are scattered through a greater range than the females. The average hand module in the male is 12.9 and in the female 11.8. The hand of the Quichua female is not only on the average narrower and shorter than that of the male but is relatively narrow in respect to its length.

Hand-Stature Index.

In the male the hand-stature index averages 10.8, the extremes are 13.1 and 9.6, and the variation range is 3.5. In the female the average is 12.5, the extremes 13.3 and 9.9, and the variation range 3.4. This greater index in the female is due largely to her shorter stature. These results are very similar to those obtained by the former expedition and the Quichua seem to closely resemble the North American Indians and Mongoloid races generally in hand proportions. No measurements were made of forearm and arm but the results of the previous expedition showed that the Quichua were high in the dolichokerkic group. The following table makes possible a comparison of the results of the two expeditions:—

	Yale-Nat. Geog. Exp. 1912	Yale-Nat. Geog. Exp. 1915
Hand-stature index ♂		
Average	10.9	10.8
Maximum	12.2	13.1
Minimum	9.6	9.6
Variation Range	2.6	3.5

The seriation table in the appendix shows that the index is more scattered in the female than in the male.

Foot Measurements.

The left foot was measured in 83 males and 68 females. The measurement was made with the weight somewhat on the toes so that they are extended rather than flexed.

In the male the average length is 238.5 millimeters, the extremes 294 and 181, and the range of variation 113. In the females the average length is 214, the extremes 235 and 192, with a variation range of 43. The results of the 1912 Expedition showed an average foot length for the male of 244, with extremes of 274 and 220, and a variation range of 54. The results of the two expeditions, so far as the average length is concerned, are nearly alike, but the extremes and variation are quite different. The female not only shows a much lower average foot length than the male but the longest female foot, 235, is less than the average male length; also the variation range is much greater in the male. Chervin found the average foot length in the male to be 238 and 56 for the range of variation; in the female 222, with a range of variation of 28.

The seriation table shows the shortest foot was found in a male, as well as the longest, also that 42.2% of the males have longer feet than the longest of the female.

In the male the foot width averages 101, the maximum 121, the minimum 89, and the variation range 32. In the female the average is 88, the maximum 97, the minimum 72, and the variation 25. This measurement was not made by the 1912 Expedition. It is worthy of notice that the maximum foot width (97) in the female is less than the average (101) of the male and also the variation range is less in the female.

Chervin's results show an average foot width in the male of 101, with a range of 29, in the female an average of 90, and a range of 12.

The seriation table of foot measurements shows that 75.9% of the males have a foot width between 95 and 105, while only 7.3% of the females are within these limits.

Foot Index.

The average foot index $\left(\frac{\text{width x 100}}{\text{length}}\right)$ in the male is 42.4, the extremes 52.5 and 34.0, and the variation range 18.5.

In the female the average is 41.2, the extremes 45.2 and 34.9, and the range of variation 10.3. The female foot is therefore smaller and relatively narrow as compared with that of the male.

Chervin gives for the Quichua male an average index of 41.77, extremes of 47.84 and 36.88, and a range of 10.96. For the female he finds an average of 40.39, extremes of 42.72 and 36.21, and a range of 6.5.

This index varies racially in the male from 38.4 to 44.8, the latter being the index for the Colorado Indians.

Foot-Stature Index.

The foot length relative to stature $\left(\frac{\text{foot length x 100}}{\text{stature}}\right)$ averages 15.0 in the male, with a maximum of 17.9, a minimum of 11.8, and a range of 8.1. In the female the average is 14.7, the extremes 17.5 and 13.6, and the variation range 3.9. This is quite similar to the results of the 1912 Expedition of 15.1 for the average index in the male, with extremes of 16.3 and 14.1, and a variation of 2.2. Chervin's results for the male are similar so far as the average is concerned (14.86), but the maximum (16.53) is somewhat less, while the minimum is greater than our results. Chervin's average for the female is 14.43. The stature-foot length index in the Quichua is about the same as in the Colorado and Brazilian Indians and the Chinese (Martin). The relative foot length, however, seems to have little value as a racial character.

Leg Circumference.

The maximum leg circumference was measured only in the left leg in 58 males and 47 females. This dimension averages in the male 341, with extremes of 390 and 268, and a range variation of 122. In the female the average is 331, the extremes are 413 and 226, with a variation range of 187. This agrees fairly well with the results of the 1912 Expedition, viz., an average for the male of 341, a maximum of 405, a minimum of 287, and the range of variation of 118. The least supramalleolar circumference was not measured but the average in the male Quichua was found by the former expedition to be 214, with a variation range of 55. Also the average leg circumference index $\left(\frac{\text{average leg circumference (least) x 100}}{\text{average leg circumference (greatest)}}\right)$ in the male was 62.8, i. e., the index is low in contrast with most races, which means that the *triceps surae* muscle is large in the Quichua. This harmonizes with the common observation and is in part due probably to the mountainous country inhabited by these people. In six instances the maximum leg circumference of the female was smaller than in any male and in eight cases larger.

The average relation of the supramalleolar circumference (greatest) to the stature is determined by the formula $\left(\frac{\text{average supramalleolar circumference x 100}}{\text{average stature}}\right)$. This gives in the male an average index of 21.5, which is the same as obtained by the former expedition, and in the female an average index of 22.8.

Martin gives the racial variation in this index from 17.8 to 21.26. This index in the Quichua male is greater than that of any race recorded and it is noteworthy that it is slightly greater in the female than the male. Martin gives for the female a racial variation from 17.7 to 25.2.

Thorax Measurements.

Measurements of the thorax were made on 85 males and 68 females, without removal of shirt or waist. The lateral and antero-posterior diameters were measured at the nipple level in medium expansion, with the arms abducted to a right angle. The average lateral diameter in the male is 304, the extremes 354 and 267, giving a variation range of 87. The average antero-posterior diameter is 224, the extremes 275 and 184, giving a variation range of 91.

In the female the average lateral diameter of the thorax is 283, the extremes 310 and 254, with a variation range of 56. The average antero-posterior diameter is 205, the extremes are 254 and 164, and the range of variation 90.

From these observations we see that the variation range is distinctly greater in the male in the case of the lateral diameter but nearly the same in both sexes in the antero-posterior diameter. The smallest male and female lateral diameters are only different by 13 millimeters in favor of the male, while the difference in the greatest lateral diameters in the two sexes is 44 millimeters in favor of the male. The least antero-posterior diameter is 20 millimeters greater in the male and the greatest diameter is larger in the male by 21 millimeters.

The seriation tables of the lateral chest measurements in the male show that 72% are included in the group between 270 and 320 millimeters, while in the females 85% are found within these limits.

In the case of the antero-posterior diameters in the male 64.7% are found between 200 and 230, while in the females only 57% lie within these dimensions.

These measurements were not made by the Expedition of 1912. The racial variations in the male are seen from the following table from Martin (9) :—

	Ant. post. diameter	Transverse	Thoracic index
African Negro	195	269	72.5
Navaho	216	297	72.9
French	194	269	72.1

The Quichua evidently have large thoraces correlated undoubtedly in part with breathing rarefied air.

The thoracic index $\left(\frac{\text{ant. post. diameter x 100}}{\text{lateral diam.}}\right)$ in the male shows an average of 73.8, extremes of 84.9 and 62.4, and a variation range of 22.5. In the female the average is 72.3, the extremes 84.6 and 57.5, the range of variation is 27.1. As this index is greater in the infant and also in the ape, our results do not support, so far as the Quichua are concerned, the assumption that the female thorax is more infantile than that of the male.

Ears.

The left ear was measured by sharp-pointed calipers. The height represents the distance from the top of the ear to the lower margin of the lobe. The breadth represents the distance from the front of the helix to the posterior margin of the ear at right angles to the height. The index determined from these measurements represents the physiognomic and not the true or morphologic index. The average ear height for the male Quichua is 6.2 mm., the greatest 7.7, the least 5.1, with a range of variation of 2.6. The average breadth is 3.8, with 4.5 for the greatest and 3.0 for the least, with a range of variation of 1.5.

The average physiognomic index is 61.1, with 76.8 as the greatest and 50.7 as the least, with a range of variation of 26.1.

In the female the average ear height is 59, with extremes of 69 and 51, and a variation range of 18. The average breadth is 35, with extremes of 44 and 30, and a variation range of 14. The physiognomic index averages 59.7, with extremes of 72.4 and 50, and a range of variation of 22.4.

The ear of the female is therefore smaller than that of the male in both length and breadth and has a less range of variation. The index is also slightly smaller than in the male but the range of variation is greater in the male. There were no observations on anomalies of ear conformation.

The following table shows the classification of the Quichua based on the ear index and that a larger percentage of the females belong to the hypermicrotic and microtic groups:—

Index		Quichua Males	Quichua Females
–54.9	Hypermicrotic	8.2 per cent	13.3 per cent
55–59.9	Microtic	31.8 per cent	38.2 per cent
60–64.9	Mesotic	35.3 per cent	29.4 per cent
65–	Macrotic	24.7 per cent	19.1 per cent

The accompanying tabulation makes possible a comparison of the ear measurements of the Quichua male with other American groups:—

	Ear Height	Ear Breadth	Physiognomic Index
South American Indian (Ehrenreich)	60.0	——	——
Shoshoni (Boas)	65.2	——	——
Eskimo (Duckworth)	67.5	31.1	53
Quichua Male (Yale-Nat. Geog. Peruvian Exp. 1912)	60.9	36.0	59.5
Quichua Male (Yale-Nat. Geog. Peruvian Exp. 1915)	62.0	38.0	61.1
Quichua (Chervin)	61.0	35.0	57

The average of the ear indices obtained by the two Yale Expeditions is distinctly greater than Chervin's results and greater than the index given by Boas for the Eskimo.

No observations were made on the auriculo-temporal angle, which was found to be medium by the former expedition.

The seriation table of ear measurements given in the appendix shows that 48.5% of the females have ears between 57 and 62 millimeters in height, while about the same percentage (47%) of males are between 59 and 66. In ear breadth 45.5% of the females are between 34 and 36, while a nearly similar percentage (43.5%) of the males are from 37 to 40. It would seem then that a larger ear in the male is a somewhat characteristic sex character of the Quichua.

Nose.

Observations on the nose included the inspection of the dorsum and the inclination of the base, the measurement of the height and breadth, and the determination of the index. The classification according to the shape of the dorsum is shown in the following table:—

	Males	Females
Concave	1.2 per cent	20.6 per cent
Slightly concave	2.3 per cent	20.6 per cent
Straight	21.2 per cent	20.6 per cent
Convex	31.7 per cent	16.2 per cent
Slightly convex	21.2 per cent	19.1 per cent
Very convex	1.2 per cent	2.9 per cent
Concavo-convex	21.2 per cent	
	100.0 per cent	100.0 per cent

The dorsum nasi, as seen from the above table, is straight in nearly equal proportion to the two sexes, is convex nearly twice as often in the male, and is concave to a much greater extent in the female. The writer found somewhat different results in the previous study; they were as follows in the male: the dorsum was straight in 29.7%, concave in 11.7%, convex in 15.2%, and sinuous in 43.4%. The nearly straight or slightly convex dorsum nasi is the predominant type in the Quichua male, while the nose of the female is more frequently concave.

The nasal depression was recorded as medium, submedium, shallow, deep, wide, high, and narrow. In the males 68.2% were of the medium type, 4.7% submedium, 8.2% shallow, 2.4% deep, 5.9% wide, 9.4% high, and 1.2% narrow.

In the females 61.8% were medium, 5.9% submedium, 19.1% shallow, 1.5% deep, and 11.7% wide. This agrees essentially with part of the observations of the 1912 Expedition, which found the nasal depression in the male medium in 64.6% but differs chiefly in the smaller per cent of those rated as high.

In the male the base of the nose is horizontal in 16.5%, inclined slightly upward in 45.9%, slightly downward in 37.6%.

In the female the base is horizontal in 11.8%, inclined slightly upward in 69.1%, and slightly downward in 19.1%. The nose of the female is more frequently concave with base inclined upward than that of the male.

The character of the root of the nose, whether projecting or depressed, depends largely upon the forward growth of the mesethmoid. This growth occurs chiefly after childhood and the greater frequency and more marked nasal depression of the female represents the more frequent persistence of the infantile type of nose in the female.

The height of the nose was measured by fine-pointed sliding compasses from the nasion to the subnasal point, and the breadth was the greatest from one ala to the opposite at their lower borders.

The nasal index expresses the relation of the breadth to the height rather than the length of the nose.

The height of the nose in the male averaged 57 millimeters, the greatest 70, the least 48, with a variation range of 22. The width averaged 40, with extremes of 47 and 34, and a variation range of 13. In the female the height averages 53 millimeters, the greatest 64 and the least 41, with a variation range of 23.

The width averages 37, the greatest 46, the least 30, and the variation range of 16.

A comparison of these measurements with those obtained by the Expedition of 1912 shows them so regularly larger, especially the height, that one must believe that a different technique was employed. The difficulty in measuring the height of the nose in the living is the determination of the nasion. The fact that the average nose height varies racially from 41.7 to 52.2 and nose breadth from 35. to 44. seems also to indicate that we are dealing here with excessive measurements of height, due probably to the inaccurate determination of the nasion, as also seemed probable in the case of the face height measurement.

The physiognomic nasal index averages in the male Quichua 70, with extremes of 86.5 and 55.2, showing a variation range of 31.3. In the female the average is 69.0, the greatest 100, and the least 55.4, with a variation range of 44.6. This average is considerably less than that obtained by the previous expedition (81.8) and is due to the greater heights obtained as a result probably of locating the nasion too high.

This average of 70 just places the male in the mesorrhine group with Chinese (72.9), Sioux (75.4), and Shoshoni (83.1). The female just fails to get into the mesorrhine group. In spite of the average index in the male placing him in the mesorrhine group, the larger percentage is found in the leptorrhine group, as indicated by the following table, showing the grouping of the Quichua according to the nasal index:—

	Males per cent	Females per cent
Leptorrhine (5–69.9)	57.7?	64.7?
Mesorrhine (70–84.9)	38.8?	30.9?
Chamaerrhine (85–99.9)	3.5?	2.9?
Hyperchamaerrhine (100–)	——	1.5?

The seriation tables indicate the extent of variability in the various nasal measurements in the male and female.

The accompanying table illustrates the relation of the shape of the nose to age. It shows that the nose is higher and broader in the old person, i. e., increases in height and breadth with age, but that the height increases more than the breadth, increase in the latter being more noticeable in the female.

QUICHUA.

Nasal Measurements and Index in Relation to Age.

MALE.

	15 Youngest.				15 Oldest.		
Age	Height of nose	Breadth of nose	Nasal index	Age	Height of nose	Breadth of nose	Nasal index
18	5.1	3.9	76.47	40	5.1	3.9	76.47
18	5.3	4.1	77.36	40	5.9	4.5	76.27
19	5.4	3.9	72.22	42	5.6	3.8	67.86
19	5.4	3.4	62.96	42	5.6	3.9	69.64
19	5.1	3.9	76.47	42	6.7	3.7	55.22
19	5.2	4.0	76.92	42	5.7	3.8	66.67
19	5.4	3.4	62.96	42	5.8	3.9	67.24
20	4.8	3.9	81.25	44	5.5	4.4	80.00
21	5.6	3.9	69.64	45	5.9	4.0	67.80
22	5.5	4.0	72.73	45	5.9	4.1	69.49
22	5.8	3.6	62.07	46	6.2	3.6	58.06
22	5.4	4.4	81.48	46	5.5	4.7	85.45
22	5.3	3.8	71.70	49	5.2	4.5	86.54
22	5.8	3.8	65.52	50	7.0	4.5	64.29
22	5.7	3.4	59.65	50	6.2	4.1	66.13
Average:							
20	5.4	3.8	71.29	44	5.9	4.1	70.48

FEMALE.

	15 Youngest.				15 Oldest.		
Age	Height of nose	Breadth of nose	Nasal index	Age	Height of nose	Breadth of nose	Nasal index
15	5.3	3.4	64.15	35	5.4	3.4	62.96
16	5.1	3.4	66.67	36	5.5	3.8	69.09
16	5.1	3.5	68.63	38	4.8	3.6	75.00
17	5.4	3.6	66.67	38	5.5	3.9	70.91
17	5.1	3.7	72.55	38	5.9	3.5	59.32
18	5.0	4.4	88.00	40	5.4	3.9	72.22
18	4.6	3.7	80.43	41	5.2	3.7	71.15
18	4.8	3.6	75.00	42	5.7	3.7	64.91
18	5.2	3.6	69.23	43	6.3	3.6	57.14
19	5.4	3.1	57.41	45	5.9	3.9	66.10
19	4.8	3.5	72.92	45	5.6	3.8	67.86
20	5.3	3.4	64.15	47	4.9	3.0	61.22
21	5.2	3.8	73.08	47	5.8	3.5	60.34
21	4.9	3.4	69.39	50	6.0	4.0	66.67
21	5.1	3.3	64.71	60	5.5	4.2	76.36
Average:							
18	5.1	3.6	70.20	43	5.6	3.7	66.75

Face.

The cephalometric morphologic face height is the distance from the menton to the nasion determined on the living person and represents the height of the face without including any of the cranium. This measurement varies to a considerable extent with age, influenced largely by the condition of the teeth. In fact this measurement in the edentulous aged would be valueless and misleading for comparison not alone on account of the absence of teeth but also because of the resulting absorption of the alveolar processes.

The average face height obtained for the male Quichua is 135. the maximum 157, the minimum 122, with the range of variation 35. In the female the average is 127, with extremes of 152 and 112, and a variation range of 40.

Our former observations on the Quichua showed the average morphologic height of the face in the male Quichua to be 116, the extremes 132 and 101, and the range of variation 31. As the morphologic face height varies racially in the male from 103 to 127 and in the female from 107 to 117, the average face height of 135 for the male and 127 for the female are so large in comparison that we suspect there may have been some error of technique, probably in locating the nasion too high. Possibly we are here dealing with the face height estimated from the Glabella. The Quichua probably occupy an intermediate position among the races in respect to face height.

The menton-crinion height gives what may be called the physiognomic in contradistinction to the morphologic face height or true face height. In the male this height averages 184, the extremes are 200 and 154, with a range of variation of 46. In the female the average is 170, the extremes 198 and 152, and the variation range 46. The physiognomic face height of the female is distinctly shorter than that of the male but has about the same extent of variation. This is clearly shown by the seriation tables.

The following selections from Martin's (9) compiled table of physiognomic facial heights show a range from 170 to 192. The male Quichua are therefore shown to be slightly above the average and the female slightly below.

	Male	Female
Mawambi pygmies	170	168
Egyptians of the Kharga-Oasis	176	——
Chiriguan	182	168
Jews	184	——
Kalmuck	185	——
Papuan	186	164
German	186	175
East African	188	——
Navaho Indian	189	177

The relation of the face height to the stature is indicated by the stature-face height index $\left(\frac{\text{height of face x 100}}{\text{stature}}\right)$ This in the male is for the average physiognomic face height 11.6 and in the female 11.7, while for the morphologic face height the index in the male averages 8.5 and in the female 8.8. This indicates that a nearly similar relationship exists in the sexes between the face height and stature.

The face breadth as exhibited by the bizygomatic diameter (zygion to zygion) averages in the male Quichua 141, with extremes of 152 and 130, with a variation range of 22. In the female the average face breadth is 134, the extremes 149 and 126, with a variation range of 23.

The face breadth varies racially from 116 to 153, and the Quichua are quite similar to the Japanese and certain Eskimo. Our former results for the male Quichua were 141 for the average, with extremes of 151 and 132, and a variation range of 19. The results obtained by the two expeditions for the face breadth are very similar but slightly greater than Chervin's results (138) in the male. While high faces are more likely to be associated with long heads, and broad faces with broad heads, there is no certain correlation, the face being more variable, as would be expected from the fact that its functions are closely connected with food and environment. Also the breadth and height of the face is correlated somewhat with the size of the head, the larger head having a broader and higher face.

The (cephalometric) morphologic facial index

$$\left(\frac{\text{menton to nasion x 100}}{\text{bizygomatic breadth}}\right)$$

averages in the male 96.3, the extremes are 117.2 and 84.7, and the variation range 32.5. In the female the average is 94.8, the extremes 109.6 and 85.9, and the variation range 23.7. The face of the female Quichua then is relatively shorter than that of the male and the index less variable.

These results are much greater than those obtained by the Expedition of 1912, where the average male index was 82.9, with a maximum of 93.2 and a minimum of 70.6, and a variation range of 22.6. As the bizygomatic breadth obtained by the two expeditions is very similar the difference in results is due to the difference in the face height measurements, which probably represents the glabella-menton height. This index varies racially from 80 to 97.2, as given by various observers.

An index of 82.9 associates the Quichua with some of the North American Indians (80.5 Boas), while an index of 96.3 would be similar to that of certain hyperleptoprosopic groups of Turkestan.

The seriation tables show a nearly similar distribution of this index in the two sexes:—

		Yale-Nat. Geog. Exp. 1912 Quichua		Yale-Nat. Geog. Exp. 1915 Quichua	
Index		121 Males per cent	1 Female per cent	85 Males per cent	67 Females per cent
(–83.9)	Euryprosopic	55.4	100	——	——
(84–87.9)	Mesoprosopic	26.4		5.9?	13.4?
(88–92.9)	Leptoprosopic	17.4		25.9?	28.4?
(93–)	Hyperleptoprosopic	0.8		68.2?	58.2?

It is clear from a comparison of the results of the two expeditions in respect to the measurements of the face height and the grouping based thereon and from the inspection of the photographs and the results of observations on other races, that the face height obtained by the last expedition is not the same measurement as that made by the first expedition. The writer is certain that the measurements obtained by the first expedition represent the menton-nasion measurement while the face height of the 1915 Expedition probably approximates the menton-glabellar height.

The physiognomic facial index $\left(\frac{\text{bizygomatic diam.} \times 100}{\text{menton-crinion height}}\right)$ in the male averages 76.9, with extremes of 88.1 and 69.5, and a variation range of 18.6. In the female Quichua the average is 78.9, with extremes of 89.5 and 71.2, and a variation range of 18.3. The difference in this index due to sex is not marked, in some instances being larger in the male and in others in the females. The sex difference in the Quichua is greater, however, than in most races.

The following list, selected from Martin's (9) table, illustrates the variations in this index in several races, the Jew having the lowest index and the Tibetan the highest physiognomic facial index. Racially the Quichua occupies an intermediate position.

	Male	Female
Jew	73.7	——
Egyptians from Kharga Oasis	74.2	——
Bushmen	76.4	76.1
Armenians	78.1	——
Finns	79.4	79.3
Chinese	87.0	——
Tibetans	98.4	94.8

It is difficult to understand why anthropologists have chosen to determine the morphologic facial index with the byzygomatic diameter for the base while, for the determination of the physiognomic index the face height is used as the base. It is the opinion of the writer that it would be much better to use the same method in both cases, using the bizygomatic breadth as the base.

The following table indicates the relationship in the proportions of the face and nose, viz., that a broad nose goes with a broad face and a high nose with a high face in both male and female Quichua.

QUICHUA.

RELATION OF FACIAL AND NASAL BREADTH IN THOSE OF THE NARROWEST AND BROADEST FACES.

15 Narrowest Faces				15 Broadest Faces			
Male		Female		Male		Female	
Face breadth	Breadth of nose	Face breadth	Breadth of nose	Face breadth	Breadth of nose	Face breadth	Breadth of nose
13.0	4.5	12.6	3.3	14.6	3.7	13.7	3.6
13.0	3.4	12.7	3.8	14.6	3.9	13.7	3.5
13.2	3.9	12.8	3.5	14.6	3.6	13.7	4.1
13.3	3.9	12.8	3.9	14.6	4.3	13.8	3.6
13.3	3.7	12.9	3.6	14.7	4.4	13.8	3.5
13.3	4.0	13.0	3.8	14.7	4.1	13.8	3.4
13.4	4.4	13.0	3.0	14.7	4.1	13.9	3.4
13.4	3.9	13.0	3.4	14.7	4.0	13.9	4.4
13.4	4.1	13.0	3.9	14.8	3.5	13.9	4.2
13.4	3.4	13.0	3.5	14.8	4.2	13.9	3.6
13.4	3.9	13.0	3.6	14.8	4.3	13.9	3.1
13.5	3.8	13.0	3.7	14.9	4.4	14.1	3.8
13.5	3.7	13.1	3.8	15.1	4.1	14.2	4.1
13.5	3.6	13.1	3.7	15.1	4.7	14.2	3.7
13.5	3.9	13.1	3.8	15.2	4.7	14.9	3.2
Average:							
13.3	3.9	12.9	3.6	14.8	4.1	14.0	3.7

Relation of Facial and Nasal Height in those of the Shortest and Longest Faces.

15 Shortest Faces				15 Longest Faces			
Male		Female		Male		Female	
Height of face menton-nasion	Height of nose	Height of face menton-nasion	Height of nose	Height of face menton-nasion	Height of nose	Height of face menton-nasion	Height of nose
12.2	5.1	11.2	5.1	14.3	5.4	13.4	5.5
12.3	5.2	11.4	5.2	14.3	6.2	13.4	5.7
12.4	5.2	11.6	5.1	14.3	5.6	13.4	5.6
12.4	5.1	11.6	4.9	14.4	7.0	13.4	5.5
12.4	5.5	11.8	4.9	14.4	6.3	13.5	5.4
12.4	5.3	11.9	5.5	14.4	5.8	13.6	5.5
12.5	5.4	12.0	5.3	14.4	5.7	13.8	6.0
12.6	6.1	12.0	5.4	14.4	6.2	13.9	6.3
12.6	6.2	12.0	5.5	14.6	5.9	13.9	5.9
12.6	5.4	12.0	5.4	14.8	6.2	14.0	5.6
12.7	6.1	12.0	5.1	14.9	6.3	14.0	5.8
12.8	5.5	12.0	5.3	15.2	5.6	14.1	5.8
12.8	5.5	12.0	4.9	15.3	5.8	14.1	6.0
12.8	5.1	12.1	4.9	15.6	5.8	14.8	6.4
12.8	6.0	12.1	5.5	15.7	5.7	15.2	5.5
Average:							
12.6	5.5	11.8	5.2	14.7	6.0	13.9	5.8

When we compare the face form as indicated by the facial index with the head form as indicated by the cephalic index, we find that the high face is associated with the relatively long head and the short face with the relatively broad head. This relationship is illustrated in the following tables, both when the face form is compared with the head form and vice versa in both sexes of the Quichua.

The accompanying table (p. 36) indicates that a broad face in both sexes of the Quichua is generally associated with a broad head, a larger cephalic index and module. There seems to be no relation to age.

The accompanying tables (pp. 37, 38) seem to show the truth of the following statements for both sexes of the Quichua: a short face is associated with a higher forehead, and a high face with a lower forehead; a short face goes with a shorter stature, and a high face with a greater stature; a short face is found with a shorter head than a high face. There is little or no relation between the height of the face and the height of the head but a short face is associated with a relatively broad head and with a smaller head as indicated by the cephalic module.

QUICHUA.

Face Form compared with Head Form.

MALE				FEMALE			
15 Lowest Facial Indices		15 Highest Facial Indices		15 Lowest Facial Indices		15 Highest Facial Indices	
Facial index	Cephalic index	Facial index	Cephalic index	Facial index	Cephalic index	Facial index	Cephalic index
84.7	84.41	102.1	81.28	85.9	79.14	99.3	76.34
85.5	80.11	102.2	77.08	86.3	81.82	100.0	78.97
87.25	80.41	102.2	85.88	86.3	82.42	100.75	79.55
87.3	73.66	102.9	78.76	86.6	85.56	100.75	80.79
87.7	84.07	103.0	80.00	87.0	74.87	101.45	78.80
88.4	75.00	103.7	73.11	87.2	82.86	101.5	81.67
88.4	81.77	104.2	78.49	87.2	83.72	101.5	76.56
88.4	80.21	104.35	75.51	87.4	87.21	102.3	78.41
89.2	82.89	104.8	77.66	87.7	80.90	102.3	82.77
89.2	82.70	106.6	77.60	88.2	79.89	102.3	79.43
90.0	83.87	107.4	84.41	88.9	81.00	103.8	78.69
90.1	81.15	108.3	81.67	88.9	85.55	104.6	81.12
90.5	77.27	108.3	73.54	88.9	82.22	106.0	90.80
90.9	80.32	110.4	78.31	89.2	79.89	109.35	78.84
90.9	77.08	117.2	80.00	90.4	83.06	109.6	80.00
Average:							
88.56	80.33	105.9	78.88	87.7	82.00	103.0	80.18

Head Form compared with Face Form.

MALE				FEMALE			
15 Lowest Cephalic Indices		15 Highest Cephalic Indices		15 Lowest Cephalic Indices		15 Highest Cephalic Indices	
Cephalic index	Facial index	Cephalic index	Facial index	Cephalic index	Facial index	Cephalic index	Facial index
71.79	100.75	82.78	95.5	78.81	97.7	82.86	87.2
73.11	103.7	82.89	89.2	72.63	96.3	82.86	94.7
73.54	108.3	83.61	94.4	74.87	87.0	83.06	90.4
73.66	87.3	83.70	99.2	75.82	92.4	83.43	93.2
74.49	94.4	83.80	92.8	76.34	95.45	83.62	91.85
74.76	96.5	83.87	90.0	76.34	99.3	83.70	92.0
75.00	88.4	84.07	87.7	76.56	101.5	83.72	87.2
75.13	99.2	84.07	95.9	77.00	94.1	84.48	96.2
75.13	100.0	84.24	92.4	77.13	98.5	84.70	92.1
75.26	95.8	84.41	107.4	77.22	95.45	85.55	88.9
75.37	97.9	84.41	84.7	77.35	93.2	85.56	86.6
75.51	104.35	84.57	95.0	77.84	95.3	86.03	95.6
75.66	100.0	85.33	92.1	78.41	102.3	86.83	97.0
76.41	94.5	85.71	91.8	78.45	93.2	87.21	87.4
76.72	98.55	85.88	92.05	78.69	103.8	90.80	106.0
Average:							
74.77	97.98	84.22	93.34	76.43	96.37	84.96	92.42

QUICHUA.

Breadth of Face in relation to Breadth, Form, Size of Head and Age.

MALE.

15 Broadest Faces					15 Narrowest Faces				
Bizygomatic breadth	Breadth of head	Cephalic index	Cephalic module	Age	Bizygomatic breadth	Breadth of head	Cephalic index	Cephalic module	Age
14.6	15.6	80.00	16.20	32	13.0	14.9	80.11	15.57	49
14.6	15.3	84.07	15.67	34	13.0	14.0	77.78	14.87	19
14.6	15.3	84.07	15.67	28	13.2	13.9	73.54	15.57	30
14.6	15.3	77.66	16.30	31	13.3	14.0	71.79	15.20	40
14.7	15.6	75.00	16.97	35	13.3	14.4	78.26	15.27	—
14.7	15.6	85.71	15.90	—	13.3	14.9	78.84	15.63	19
14.7	15.7	81.77	16.13	24	13.4	14.9	79.68	15.70	26
14.7	15.4	80.21	15.93	28	13.4	14.1	78.77	15.00	18
14.8	15.3	82.70	15.77	29	13.4	14.9	82.78	15.30	—
14.8	15.3	82.26	15.87	—	13.4	15.2	80.00	16.00	22
14.8	15.3	77.27	16.27	24	13.4	15.4	80.21	16.03	20
14.9	15.6	80.41	16.33	35	13.5	15.4	83.70	15.73	30
15.1	15.7	85.33	16.17	—	13.5	13.9	73.11	15.30	40
15.1	15.2	85.88	15.33	—	13.5	14.6	82.02	15.20	34
15.2	15.5	79.08	16.30	—	13.5	14.3	75.66	15.53	30
Average:									
14.8	15.4	81.43	16.05	30	13.3	14.6	78.42	15.46	29

FEMALE.

15 Broadest Faces					15 Narrowest Faces				
Bizygom-breadth	Breadth head	index	module	Age	Bizygom-breadth	Breadth head	index	module	Age
13.7	14.7	76.56	15.70	43	12.6	14.5	81.00	15.13	22
13.7	14.7	81.67	15.33	38	12.7	13.7	79.65	14.90	45
13.7	15.4	83.70	15.67	22	12.8	13.7	77.84	14.73	19
13.8	15.4	78.80	15.30	26	12.8	14.2	80.68	14.97	21
13.8	14.6	81.56	15.10	24	12.9	14.7	81.67	15.13	18
13.8	14.0	74.87	15.50	—	13.0	14.4	79.12	15.27	21
13.9	14.4	80.90	14.93	15	13.0	14.2	82.56	14.63	27
13.9	15.1	79.89	15.70	18	13.0	14.9	82.77	15.23	20
13.9	14.9	78.84	15.53	60	13.0	14.6	81.12	15.07	38
13.9	15.0	82.42	15.33	26	13.0	14.3	79.44	15.07	21
13.9	14.4	84.70	15.00	19	13.0	14.1	79.21	14.90	34
14.1	15.4	78.97	16.03	22	13.0	13.5	71.81	15.17	22
14.2	15.4	85.56	15.53	32	13.1	14.3	79.89	15.30	26
14.2	14.9	80.98	15.27	23	13.1	13.8	78.41	14.77	42
14.9	14.8	79.14	15.53	25	13.1	13.9	79.43	14.77	26
Average:									
14.0	14.9	80.57	15.43	28	12.9	14.2	79.64	15.00	27

QUICHUA.

Relation of Face Height and Forehead Height to Stature, Head Length, Head Height, Cephalic Index and Head Size.

MALE.

15 Shortest Faces

Height of face menton-nasion	Height of forehead nasion-crinion	Stature	Length of head	Height of head	Cephalic index	Cephalic module	Facial index morphologic
12.2	6.2	157.6	18.6	13.9	84.41	16.07	78.3
12.3	4.3	152.8	18.4	13.0	78.26	15.27	95.2
12.4	5.7	——	18.6	13.2	80.11	15.57	95.4
12.4	5.2	157.0	18.6	13.0	80.11	15.50	85.5
12.4	4.6	159.1	20.5	14.7	73.66	16.77	87.3
12.4	5.3	161.0	18.7	13.8	82.89	16.00	89.2
12.5	4.4	148.8	18.2	12.9	80.77	15.27	92.6
12.6	4.2	152.4	18.6	13.8	83.87	16.00	90.0
12.6	4.8	160.4	18.7	13.5	79.68	15.70	94.0
12.6	4.6	155.9	18.0	12.6	77.78	14.87	96.9
12.7	3.3	160.1	18.7	13.6	80.21	15.77	91.4
12.8	5.4	——	19.1	13.5	81.15	16.03	90.1
12.8	5.4	101.9	17.9	12.3	83.80	15.07	92.8
12.8	2.6	140.9	17.9	13.0	78.77	15.00	95.5
12.8	4.7	157.6	18.2	13.5	84.07	15.67	87.7
Average:							
12.6	4.7	155.8	18.6	13.4	80.64	15.64	90.9

15 Highest Faces

Height of face menton-nasion	Height of forehead nasion-crinion	Stature	Length of head	Height of head	Cephalic index	Cephalic module	Facial index morphologic
14.3	4.9	161.9	19.6	13.8	79.08	16.30	94.1
14.3	—	182.5	19.3	13.5	75.13	15.77	100.0
14.3	4.4	125.2	18.9	13.9	73.54	15.57	108.3
14.4	5.0	144.8	19.3	13.2	78.76	15.90	102.9
14.4	5.0	172.6	19.0	13.5	78.42	15.73	101.4
14.4	4.3	156.4	18.5	13.5	80.00	15.60	99.3
14.4	5.0	158.8	18.7	13.9	81.28	15.93	102.1
14.4	5.2	——	19.6	13.1	75.51	15.83	104.4
14.6	4.9	157.6	19.2	13.6	77.60	15.90	106.6
14.8	—	155.5	18.6	12.0	78.49	15.37	104.2
14.9	4.3	175.1	18.9	13.6	78.31	15.77	110.4
15.2	3.2	150.0	18.6	14.0	84.41	16.10	107.4
15.3	2.9	171.5	19.7	13.9	77.66	16.30	104.8
15.6	4.0	156.5	18.0	13.7	81.67	15.47	108.3
15.7	3.1	162.3	19.0	13.8	80.00	16.00	117.2
Average:							
14.7	4.3	159.3	19.0	13.6	78.66	15.83	104.8

QUICHUA.

Relation of Face Height and Forehead Height to Stature, Head Length, Head Height, Cephalic Index and Head Size.

FEMALE.

15 Shortest Faces

Height of face menton-nasion	Height of forehead nasion-crinion	Stature	Length of head	Height of head	Cephalic index	Cephalic module	Facial index morphologic
11.2	4.4	137.5	17.9	13.0	81.00	15.13	88.9
11.4	5.0	142.1	17.8	12.6	80.90	14.93	87.7
11.6	5.4	144.5	17.5	12.6	82.86	14.87	87.2
11.6	4.1	148.8	17.2	12.9	83.72	14.83	87.2
11.8	3.5	141.2	17.2	13.3	87.21	15.17	87.4
11.9	5.5	147.0	17.9	13.7	79.89	15.30	90.8
12.0	4.8	144.2	17.6	13.3	81.82	15.10	86.3
12.0	3.2	140.9	18.9	13.8	79.89	15.93	88.2
12.0	4.2	141.5	17.3	13.7	85.55	15.27	88.9
12.0	5.1	142.7	18.2	12.8	82.42	15.33	86.3
12.0	5.2	147.6	18.0	13.1	82.22	15.30	88.9
12.0	4.5	159.5	18.0	12.9	79.44	15.07	92.3
12.0	3.8	150.2	18.7	13.8	74.87	15.50	87.0
12.1	4.1	142.4	17.9	12.7	81.56	15.07	91.0
12.1	3.9	143.6	17.2	12.5	82.56	14.63	93.1
Average:							
11.8	4.4	144.9	17.8	13.1	81.72	15.16	88.7

15 Highest Faces

Height of face menton-nasion	Height of forehead nasion-crinion	Stature	Length of head	Height of head	Cephalic index	Cephalic module	Facial index morphologic
13.4	4.8	141.5	17.6	12.7	79.55	14.77	100.75
13.4	4.1	152.7	17.6	12.9	78.41	14.77	102.3
13.4	3.7	144.5	17.5	12.9	79.43	14.77	102.3
13.4	4.5	154.6	18.6	12.9	76.34	15.23	99.3
13.5	3.7	144.8	17.7	12.7	80.79	14.90	100.75
13.6	4.4	——	18.0	12.6	81.12	15.07	104.6
13.8	3.6	168.1	18.3	13.3	78.69	15.33	103.8
13.9	4.3	150.6	19.2	13.2	76.56	15.70	101.5
13.9	4.4	150.0	18.0	13.3	81.67	15.33	101.5
14.0	4.9	157.0	18.4	13.0	78.80	15.30	101.45
14.0	3.6	152.1	17.0	13.6	84.70	15.00	98.6
14.1	3.8	125.2	16.3	12.9	90.80	14.67	106.0
14.1	5.7	164.6	19.5	13.2	78.97	16.03	100.0
14.8	3.3	125.1	18.0	13.4	80.60	15.27	109.6
15.2	3.0	156.4	18.9	12.8	78.84	15.53	109.35
Average:							
13.9	4.1	149.0	18.0	13.0	80.31	15.18	102.79

Head Measurements.

The head measurements were made in 85 males and 68 females. The length was measured from the glabella to the occipital point. The breadth was the greatest diameter at right angles with the length. The height was the distance from the binauricular line on the floor of the external auditory canal to the bregma. The head height was determined by Hrdlička's method, with a spreading and sliding compass, the ends of the spreading compass being placed in the external auditory meati with the scale over the bregma and a reading made. The distance from the scale arm to the bregma is measured by the arm of the sliding compass and subtracted from the vertical distance from the plane of the lower edge of the compass points to the scale arm. This gives the vertical distance from the plane of the meatal floor to the bregma or the head height. There is some chance for error in this measurement on account of the difficulty of locating the bregma in the living.

In the male the head length averages 190 millimeters, with a maximum of 208 and a minimum of 177, and a variation range of 31. In the female the average length is 180, the extremes 195 and 163, and the variation range 32.

The head breadth in the male averages 150, the greatest is 159, the least is 139, and the variation range is 20. In the female the average breadth is 145, the greatest 154, the least 135, and the variation range 19. The head height in the male averages 134, the extremes are 147 and 121, with a variation range of 26. In the female the average height is 130, the greatest 139, the least 124, and the variation range 15.

All three of the head measurements in the female are less than in the male but there is less difference in the height than in the other dimensions. The range of variation is nearly the same in both sexes in the length and breadth, but is distinctly less in the female in the case of the height.

Both the average head length and breadth in the male as obtained by the Expedition of 1915 are distinctly greater than Chervin's results or those of the Expedition of 1912. The head height as determined by the 1915 Expedition agrees with Chervin's results but is somewhat greater than that obtained by the 1912 Expedition.

The following tables make possible a ready comparison of the results of former observers with our results:—

QUICHUA.

	Chervin Male (67)	Chervin Female (8)	Yale-Nat. Geog. Exp. 1912 Male (123)	Yale-Nat. Geog. Exp. 1912 Female (1)	Yale-Nat. Geog. Exp. 1915 Male (85)	Yale-Nat. Geog. Exp. 1915 Female (68)
Head length						
Average	182	180	185	185	190	180
Maximum	192	185	201		208	195
Minimum	120	175	172		177	163
Range of variation ..	72	10	29		31	32
Head breadth						
Average	147	143	148	147	150	145
Maximum	158	146	160		159	154
Minimum	138	138	139		139	135
Range of variation ..	20	8	21		20	19
Head height						
Average	134	134	129	132	134	130
Maximum	169	148	146		147	139
Minimum	119	120	115		121	124
Range of variation ..	50	28	31		26	15
Cephalic index						
Average	82	79.46	79.9	79.4	79.46	80.71
Maximum	94.29	81.14	90.2		85.88	90.80
Minimum	72.92	75.82	73.1		71.79	71.81
Range of variation ..	21.37	5.32	17.1		14.09	18.99

The average cephalic index as determined by the two expeditions is practically the same but distinctly less than Chervin's results. The average index in the female is somewhat greater than that in the male but both just come within the mesaticephalic group (76–80.9) barely escaping the brachycephalic class. The seriation table shows that 15.3% of the males are dolichocephalic (–75.9), 55.3% mesaticephalic, and 29.4% brachycephalic (81–). In the case of the females 5.9% are dolichocephalic, 48.5% are mesaticephalic, and 45.6% brachycephalic. Brachycephaly is therefore more frequent and dolichocephaly less frequent in the female than in the male.

The following table makes possible a comparison with Chervin's results:—

	Chervin		Yale-Nat. Geog. Exp. 1912		Yale-Nat. Geog. Exp. 1915	
	Male (75)	Female (8)	Male (144)	Female (1)	Male (85)	Female (68)
Dolichocephalic	4.5		9.9		15.3	5.9
Mesaticephalic	32.8		33.9	100	55.3	48.5
Brachycephalic	62.7		56.2		29.4	45.6

This shows a marked difference in the results of the two expeditions in the percentages in the brachycephalic and mesaticephalic groups. This discrepancy is not so significant, however, when we note that the average cephalic index determined by the two expeditions is nearly the same (80.7 and 79.9). The explanation seems to be that a considerable proportion of cases lie on the border line between the mesaticephalic and brachycephalic groups and a slight difference increases markedly one or the other group.

Eaton (3) found in Quichua skulls exhumed at Machu Picchu, of late pre-Columbian or early post-Columbian age, an average cranial index of 78.5 in the male (11 individuals and 82.2 in the female (43). This does not differ materially from the results obtained for the living Quichua of the present time.

Cephalic Module.

The cephalic module $\left(\frac{L+B+H}{3}\right)$ represents better the size of the head than any single measurement. This module was determined for 85 males and 68 females. The average module in the male is 15.7, the extremes 16.9 and 14.8, and the range of variation 2.1. In the female the module averages 15.2, the extremes 16.0 and 14.6, and the variation range 1.4. The head of the Quichua female then, as indicated by the module, is smaller than that of the male as is usual in other races, and the variation range is less. This smaller variation in the cephalic module in the female may be correlated largely with the smaller variation range in the female stature as the size of the cranium varies with stature, being larger in the taller. The average cephalic module for the male as determined by the 1912 Expedition was 15.4, as compared with 15.7 obtained by the last expedition.

Eaton's (3) determinations for the cranial module of old exhumed Quichua skulls were 14.6 for the male (9) and 14.1 for the female (38). In both sexes the module is smaller than that found in the present living Quichua, the difference probably being due to the soft tissues.

The module varies in different North American Indians from 15.5 to 16.0, with a mean of 15.7, corresponding closely to that of the Quichua. Hrdlička gives the average cephalic module for 50 Apache Indians having an average stature of 170 at 16.0.

The seriation tables show that 84.7% of the males have a cephalic module between 15.2 and 16.2, while only 36.7% of the females lie within this limit, none being above the highest limit.

Cephalic Module and Stature.

The relation of the stature to the size of the cranium, and therefore to the brain, may be shown by the cephalic module-stature index $\left(\frac{\text{cephalic module x 100}}{\text{stature}}\right)$. In the male Quichua with an average stature of 158.4, this index averages 100.0, with extremes of 124.4 and 86.4, and a variation range of 38. In the female the average is 1.05, the extremes 122.1 and 91.2, and the variation range 30.9. The average is higher in the female, chiefly on account of the shorter stature. This index in the male of the Kharga Oasis is 94 (Hrdlička) and in the negro (American) 95.0. The Otomi (N. A. Indian), according to Hrdlička, with an average stature of 159.3 have a head-stature index of 97.3, and the Apache with an average stature of 170.0 have an index of 94., while the Quichua of the same average height has a cephalic module of 15.8 and an index of 92.8. The Quichua seems to have a head somewhat smaller for a given stature than most of the North American Indians.

The table showing the stature, cephalic module and head-stature index shows that the taller male Quichua have absolutely larger heads than the shorter, but not relatively to stature. The changes in stature are more rapid than the changes in head size in going from the short to the tall. The same is true for the female, the head is larger absolutely in the taller, but relatively to stature it is smaller. Also the female Quichua of the same average stature as the male has a smaller head but a larger head-stature index.

Hrdlička has shown also that in the natives of the Kharga Oasis there is a relation between the cephalic index and the size of the head, viz., that those with a higher cephalic index are more likely to have larger heads.

The following table illustrates the relation of stature to the cephalic module in the tall, medium, and short male and female Quichua:—

THE CEPHALIC MODULE AND HEAD-STATURE INDEX IN THE SHORT, MEDIUM AND TALL.

Male Quichua: Stature	Cephalic module	Cephalic module-stature index	Female Quichua: Stature	Cephalic module	Cephalic module-stature index
SHORT.					
below 152			below 142		
125.0	15.30	122.4	125.	14.73	117.8
125.2	15.57	124.4	125.2	15.13	120.8
140.9	15.90	112.8	125.2	14.67	117.2
144.8	15.90	109.8	125.5	15.17	120.9
147.6	15.57	105.5	128.7	15.13	117.6
148.2	15.47	104.4	135.3	15.53	114.8
148.8	15.27	102.6	137.5	15.13	110.0
150.	16.10	107.3	140.9	15.93	113.1
150.6	15.80	104.9	141.5	14.77	104.4
			141.8	15.27	107.7
9 cases					
Average:					
142.3	15.65	110.5	132.66	15.146	114.43
MEDIUM.					
156-160			146-150		
156.1	15.20	97.4	146.	15.67	107.3
156.5	15.47	98.8	147.	15.3	104.1
156.6	15.93	101.7	147.6	15.3	103.7
157.1	16.03	99.7	148.8	14.83	99.7
157.6	15.67	99.4	149.1	15.1	101.3
157.6	15.90	100.9	149.7	15.07	100.7
158.8	15.93	100.3	149.8	15.27	101.9
158.9	15.80	99.4	148.8	15.23	101.7
159.3	15.40	96.7	150.	15.33	102.2
159.8	15.87	99.3	150.	15.23	101.5
Average:					
157.83	15.72	99.36	148.78	15.23	102.41
TALL.					
Above 165			Above 155		
165.2	15.30	92.6	156.1	14.93	95.6
165.2	15.30	92.6	156.4	15.53	99.3
166.2	15.83	95.2	157.	15.30	98.0
166.5	15.97	95.9	157.6	15.63	99.2
166.9	15.73	94.2	157.9	15.47	98.0
167.3	16.13	96.4	159.1	15.47	97.2
171.1	15.97	93.3	159.5	15.07	94.5
180.6	16.07	89.0	164.6	16.03	97.4
182.5	15.77	86.4	168.1	15.33	91.2
Average:					
170.1	15.79	92.8	159.6	15.42	96.7

Head-Height Index.

The head-height index averages in the male 70.9, with extremes of 78.2 and 62, and a variation range of 16.2. In the female the average is 72.5, the extremes 80.2 and 67., and the range of variation 13.2. The head height relative to the length seems therefore greater in the female. Chervin found an average index in the male of 73.57 and in the female 74.61, the Expedition of 1912, an average index of 68.6 in the male.

The seriation table shows that 2.4% of the males are orthocephalic (58–62.9), 97.6% hypsicephalic (63–) and none chamaecephalic (–57.9). In the females none belong to the orthocephalic or chamaecephalic groups, 100% being hypsicephalic. Relatively high heads seem to be a marked character of the Quichua, and especially of the female.

Head Height-Breadth Index.

The average head height-breadth index in the male Quichua is 89.3, while in the female it is 89.6$\left(\frac{\text{average head height x 100}}{\text{average head breadth}}\right)$ which agrees closely with the former results of 89.2. This places the Quichua high among the races in respect to this index, which varies racially from 75.3 to 97.5 (Martin 8).

The average face breadth-head breadth index in the male is 94.0, which corresponds closely to the results of the previous expedition (94.2), and in the female 92.4. Both male and female are therefore cryptozygous.

The data for estimating the gonio-zygomatic index were not obtained. Our former results showed an average index in the male of 73.5, which is low in comparison with that of other races.

Cranial Capacity and Brain Weight.

If we estimate the brain weight from the stature (brain weight for males equals stature in centimeters x 7; for females equals stature in centimeters multiplied by $\left(\frac{7 \times 30}{31}\right)$ we obtain for the male Quichua 1108.8 grams and for the female 987.2 grams. By the use of Gladstone's (5) formula, which holds true for ages from 20 to 46 $\left(\text{weight in grams} = \frac{\text{L x B x H (auricular) in centimeters}}{2.806}\right)$ we find for the male a brain weight of 1361. grams and for the female a weight of 1209.2 grams.

By the Lee-Pearson formula for determining the cranial capacity in the living from the length, breadth, and auricular height of the cranium, (.000337 (l–11) (b–11) (h–11) + 406.01 ♂) we obtain 1437.4 cc. for the average cranial capacity in the male. From the formula (.000400 (l–11) (b–11) (h–11) + 206.6 ♀) we obtain an average cranial capacity for the female of 1284.5. If we multiply the cranial capacity in cubic centimeters by .87 (Manouvrier) we obtain an average brain weight for the male of 1250.5 grams and 1117.5 grams for the female.

Eaton's (3) study of the cranial capacity of old exhumed Quichua skulls gave an average of 1181.7 cc. in the female (33) and 1356.6 in the male (7). This is about 100 cc. less than was found in the present living Quichua and probably represents the imperfection of the formulary method of determining the cranial capacity in the living rather than an increased cranial capacity.

The Expedition of 1912 found the cranial capacity and brain weight of the male Quichua somewhat less, viz., 1354 cc. for the average cranial capacity and 1178 grams for the average brain weight (Lee-Pearson formula). The Quichua male is, therefore, mesocephalic and the female microcephalic. The difference in cranial capacity and brain weight in the male and female Quichua is, however, quite similar to the sex difference in other races.

Summary.

The measurements here recorded represent the Quichua of a somewhat restricted region, viz., the provinces of Urubamba and Convencion. Inasmuch as fewer measurements were made, some of the data obtained by the former expedition cannot be further tested or corroborated. Nineteen measurements were made on 85 males and 68 females and full face and profile photographs were taken.

Both congenital and acquired malformations were very few and anomalies infrequent. Pockmarked individuals, however, were numerous. Enlarged thyroids were frequent, 12.9% of the males and 16.1% of the females exhibiting this condition, which seemed more prevalent in the regions where the drinking water came from the glaciers and is occasioned by this water according to the prevailing opinion among the natives.

The pulse rate averaged 74 in the male and 78 in the female, the respiration rate 17.2 in the male and 17.9 in the female.

The hand grip was generally weak in both sexes, agreeing with the results of the former expedition.

The skin color is brown, being slightly lighter in the female: the hair straight and black. Cavities and gray hair were very infrequent and no sex difference in these respects observed Facial hair is sparse or lacking. The predominant eye color is dark brown and the conjunctiva is generally yellowish in both sexes but to a greater extent in the male. The inner canthus is generally lower than the outer.

The lips are medium in thickness and projection, chin medium in prominence, the malars prominent, the face broad and the forehead medium high but lower in the females.

It should be understood that the nasal height measurements are very certainly to some point above the nasion, possibly the glabella. The straight or slightly convex nose with medium root depression is preponderant in the male, while the straight or concave nose with medium root depression is the prevailing type in the female. The base of the nose is inclined upward in nearly one-half of the males and in about seven-tenths of the females. The nose is mostly mesorrhine or leptorrhine. The ear is medium in size and mesotic or microtic in type.

Both the hand and foot are smaller and more slender in the female and the foot is shorter relatively to the stature.

The Quichua are of "low stature," about the same as the Eskimo, and the females are shorter than the males by 130 mm. on the average. The lower extremities are relatively short, the *triceps surae* muscle is large and the leg circumference-stature index is greater than any recorded by Martin.

The Quichua are mesocephalic and the cranial capacity is less in the female and while all the head diameters are greater in the male the head height differs least. The cephalic module averages 15.7 in the male and slightly less in the female, being quite similar to that of some of the North American Indians of similar stature.

While the Quichua as a whole are mesaticephalic, just escaping brachycephaly, a larger proportion of the females than males are brachycephalic.

The head-height index is large in the Quichua, most of the males and all of the females being hypsicephalic. The head-breadth index also is large in both sexes in comparison with that of many other races. The brain weight is medium or small and averages 1250 grams in the male and 1117 in the female.

TABLE OF AVERAGES AND EXTREMES.

QUICHUA.

APPROXIMATE AGE.

	Average	Oldest	Serial No.	Youngest	Serial No.
Male	31	49	6	18	86, 57
Female	28	60	44	15	13

HAND PRESSURE.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Left	22	43	92	5	39	38
Right	24	42	149	5	39	37

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Left	9.3	23	91	2	59, 38	21
Right	11.2	24	91	2	38	22

PULSE AND RESPIRATION.

	Average	Highest	Serial No.	Lowest	Serial No.	Range of variation
MALES.						
(85 cases) Pulse	74.3	102	78	54	21	48
(78 cases) Respiration	17.2	21	71, 73, 81, 95	14	15, 17, 52, 148, 149, 153	7
FEMALES.						
(64 cases) Pulse	77.6	92	61	60	72	32
(55 cases) Respiration	17.9	21	47, 50, 76, 80	14	126, 145	7

BODY MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Height	158.4	182.5	132	125.0	113	57.5
Sitting height	83.0	94.1	115	64.1	109	30.0
Sitting height-stature index	52.54	70.0	144	35.6	105	34.4

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Height	145.4	168.1	124	125.0	150	43.1
Sitting height	80.4	89.0	67, 98	69.8	38, 51	19.2
Sitting height-stature index	55.57	70.29	143	48.61	51	21.68

LEFT HAND MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Left hand, length	17.1	18.8	105	14.9	39	3.9
Left hand, width	8.8	9.7	114	7.6	57	2.1
Hand index	51.3	56.4	39	45.4	133	11.0
Stature-hand index	10.78	13.1	113	9.6	132	3.5

FEMALES.

Left hand, length	15.9	17.4	13	14.4	59, 116	3.0
Left hand, width	7.75	8.6	45	6.7	59	1.9
Hand index	48.8	53.4	45	44.2	97	9.2
Stature-hand index	12.46	13.3	145	9.9	142	3.4

FOOT AND LEG MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Left foot, length	23.85	29.4	84	18.1	11	11.3
Left foot, width	10.1	12.1	132	8.9	34, 52, 57, 113	3.2
Foot index	42.4	52.5	11	34.0	84	18.5
Left leg, circum. max.	34.1	39.0	135	26.8	64	12.2
Stature-foot index	15.0	17.9	113, 144	11.8	11	6.1
Stature-leg circ. index	21.59	25.55	144	16.77	64	8.78

FEMALES.

Left foot, length	21.4	23.5	124	19.2	23	4.3
Left foot, width	8.8	9.7	47	7.2	59	2.5
Foot index	41.2	45.2	90	34.9	98	10.3
Left leg, circum. max.	33.1	41.3	142	22.6	54	18.7
Stature-foot index	14.7	17.5	146	13.6	23, 72	3.9
Stature-leg circ. index	22.76	31.1	150	15.7	54	15.4

CHEST MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Chest d. lateral	30.4	35.4	132	26.7	777	8.7
Chest d. ant. post.	22.4	27.5	135	18.4	107	9.1
Chest index	73.83	84.88	135	62.39	34	22.49

FEMALES.

Chest d. lateral	28.3	31.0	99, 128	25.4	122	5.6
Chest d. ant. post.	20.5	25.4	99	16.4	9	9.0
Chest index	72.28	84.65	122	57.54	9	27.11

EAR MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Height	6.2	7.7	144	5.1	117	2.6
Breadth	3.8	4.5	136	3.0	3	1.5
Index	61.1	76.8	138	50.65	144	26.15
FEMALES.						
Height	5.9	6.9	121	5.1	150	1.8
Breadth	3.5	4.4	126	3.0	58	1.4
Index	59.7	72.4	128	50.0	8, 67, 125	22.4

NOSE MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Nose, height to nasion ?	5.7	7.0	39	4.8	137, 138, 153	2.2
Nose, width max.	4.0	4.7	27, 36, 135	3.4	43, 78, 111, 117	1.3
Nasal index ?	69.98	86.54	6	55.22	69	31.32
FEMALES.						
Nose, height to nasion ?	5.3	6.4	146	4.1	126	2.3
Nose, width max.	3.7	4.6	131	3.0	76	1.6
Nasal index ?	68.99	100.0	126	55.36	123	44.64

FACE MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Face: menton-nasion ?	13.5	15.7	117	12.2	65	3.5
Menton-crinion	18.45	20.0	30	15.4	57	4.6
Nasion-crinion ?	4.8	6.6	30	2.6	57	4.0
D. bizygom. max.	14.1	15.2	36	13.0	6, 111	2.2
Facial index, morph. ?	96.35	117.2	117	84.7	65	32.5
Facial index, physiognomic	76.9	88.1	140	69.5	19	18.6
Mouth width	5.4	6.9	36	4.5	11, 19, 52, 137	2.4
FEMALES.						
Face: menton-nasion ?	12.7	15.2	44	11.2	14	4.0
Menton-crinion	17.0	19.8	142	15.2	31	4.6
Nasion-crinion ?	4.3	5.7	142	2.9	54	2.8
D. bizygom. max.	13.4	14.9	37	12.6	14	2.3
Facial index, morph. ?	94.8	109.6	146	85.9	37	23.7
Facial index, physiog.	78.9	89.5	31	71.2	142	18.3
Mouth width	5.1	6.2	121	4.3	14, 48	1.9

HEAD MEASUREMENTS.

MALES.

(Number of Individuals 85)

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
D. ant. posterior	19.0	20.8	24	17.7	134	3.1
D. lateral max.	15.0	15.9	84	13.9	70, 144	2.0
Height, line between auditory meati to bregma	13.4	14.7	27	12.1	1	2.6
Cephalic index	79.46	85.88	134	71.79	1	14.09
Head-height index	70.94	78.2	34	62.0	1	16.2
Cephalic module	15.76	16.97	24	14.87	111	2.10
Ceph. mod.—stature	100.0	124.4	144	86.4	132	38.0

FEMALES.

(Number of Individuals 65)

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
D. ant. posterior	18.0	19.5	142	16.3	125	3.2
D. lateral max.	14.5	15.4	106, 126, 142, 152	13.5	145	1.9
Height, line between auditory meati to bregma	13.0	13.9	123	12.4	62	1.5
Cephalic index	80.71	90.80	125	71.81	145	18.99
Head-height index	72.5	80.2	122	67.0	116	13.2
Cephalic module	15.20	16.03	142	14.63	51, 118	1.40
Ceph. mod.—stature	105.0	122.1	146	91.2	124	30.9

SERIATION TABLE.

QUICHUA.

APPROXIMATE AGE.

Years	Male	Female	Years	Male	Female	Years	Male	Female
15	—	1	28	3	1	43	—	1
16	—	2	29	2	—	44	1	—
17	—	2	30	7	1	45	2	2
18	2	4	31	2	—	46	2	—
19	5	2	32	2	3	47	—	2
20	1	1	34	4	2	48	—	—
21	1	4	35	5	1	49	1	—
22	6	5	36	2	1	50	2	1
23	1	5	38	—	3	60	—	1
24	4	2	39	1	—			
25	—	5	40	3	1		71	61
26	7	4	41	—	1			
27	—	2	42	5	1			

HAND PRESSURE.

Kilos	Males Right	Males Left	Females Right	Females Left	Kilos	Males Right	Males Left	Females Right	Females Left
2			1	1	23	8	8	2	1
3			2	5	24	6	6	1	—
4			2	5	25	5	1		
5	1	1	1	3	26	2	3		
6	1	—	3	8	27	1	2		
7	—	—	5	1	28	3	5		
8	—	1	7	7	29	2	4		
9	—	3	6	7	30	1	1		
10	1	—	5	2	31	1	—		
11	2	3	1	—	32	5	2		
12	2	2	5	5	33	3	2		
13	2	2	5	6	34	1	4		
14	—	3	4	3	35	3	—		
15	3	3	4	2	36	1	1		
16	4	4	4	4	37	—	1		
17	—	1	1	1	38	3	—		
18	4	2	—	—	39	1	—		
19	5	6	1	1	40	—	—		
20	3	5	—	—	41	—	—		
21	4	3	1	—	42	1	—		
22	5	4	1	—	43	—	1		
						84	84	62	62

PULSE.

	Male	Female		Male	Female		Male	Female
54	1		71	1	2	85	5	—
58	2		72	3	3	86	—	1
59	2		73	—	1	87	—	—
60	1	1	74	3	1	88	2	5
61	2	1	75	2	—	89	—	—
62	—	—	76	4	4	90	2	2
63	7	2	77	1	1	91	1	1
64	5	2	78	3	6	92	1	1
65	4	1	79	5	3	96	1	
66	1	—	80	5	3	102	1	
67	3	2	81	4	6			
68	2	3	82	5	3		85	64
69	2	—	83	1	3			
70	1	1	84	2	5			

RESPIRATION.

	Male	Female		Male	Female		Male	Female
14	6	2	17	14	13	20	7	9
15	7	3	18	16	11	21	4	4
16	17	7	19	7	6			
							78	55

HEIGHT.

	Male	Female		Male	Female		Male	Female
124	2	7	146	1	3	168	—	1
126	—	—	148	2	5	170	2	
128	—	1	150	2	8	172	1	
130	—	—	152	8	5	174	1	
132	—	—	154	8	1	176	—	
134	—	2	156	14	5	178	—	
136	—	1	158	6	2	180	1	
138	—	—	160	12	—	182	1	
140	1	7	162	5	—			
142	—	7	164	6	1		79	66
144	1	10	166	5	—			

SITTING HEIGHT.

	Male	Female		Male	Female		Male	Female
64	5		76	5	8	88	5	3
66	—		78	3	14	90	5	
68	—	2	80	9	13	92	1	
70	—	1	82	12	7	94	1	
72	—	3	84	11	9			
74	4	4	86	19	4		80	68

SITTING HEIGHT PER CENT OF TOTAL HEIGHT.

	Male	Female
35	1	
36	1	
37	1	
38	2	
48	1	1
49	2	3
50	5	3
51	14	5
52	14	3
53	13	9
54	12	15
55	3	5
56	3	4
57	4	6
58	—	2
59	—	2
60	1	1
61	—	—
62	1	1
63	—	1
64	—	1
65	—	2
66	—	1
70	1	1
	79	66

CHEST MEASUREMENTS.

Chest d. lateral

	Male	Female
25		3
26	3	7
27	8	16
28	11	20
29	9	16
30	20	4
31	13	2
32	17	
33	3	
34	0	
35	1	
	85	68

Chest d. ant. post.

	Male	Female
16		1
17		4
18	1	6
19	2	13
20	6	18
21	22	16
22	27	5
23	22	3
24	1	1
25	2	1
26	1	
27	1	
	85	68

Chest index

	Male	Female
57		1
62	1	1
63	0	1
64	0	2
65	3	3
66	3	3
67	2	1
68	6	5
69	6	4
70	4	4
71	6	5
72	12	6
73	3	7
74	6	7
75	5	7
76	9	—
77	3	4
78	2	1
79	3	1
80	2	1
81	1	3
82	4	—
83	1	—
84	3	1
	85	68

LEFT HAND MEASUREMENTS.

Left hand, length	Male	Female
14.4		2
14.5		0
14.6		0
14.7		2
14.8		1
14.9	1	2
15.0	0	1
15.1	0	4
15.2	1	3
15.3	0	3
15.4	0	2
15.5	0	2
15.6	0	4
15.7	2	2
15.8	1	4
15.9	3	5
16.0	1	1
16.1	3	2
16.2	1	2
16.3	1	4
16.4	4	7
16.5	0	3
16.6	6	3
16.7	2	1
16.8	9	3
16.9	4	2
17.0	4	0
17.1	3	2
17.2	2	0
17.3	0	0
17.4	6	1
17.5	3	
17.6	6	
17.7	7	
17.8	1	
17.9	3	
18.0	0	
18.1	1	
18.2	4	
18.3	2	
18.4	—	
18.5	1	
18.6	2	
18.7	—	
18.8	1	
	85	68

Left hand, width	Male	Female
6.7		1
6.8		0
6.9		0
7.0		1
7.1		2
7.2		1
7.3		1
7.4		7
7.5		3
7.6	1	10
7.7	1	11
7.8	0	7
7.9	0	4
8.0	1	5
8.1	4	7
8.2	3	4
8.3	0	2
8.4	9	1
8.5	11	0
8.6	8	1
8.7	6	
8.8	5	
8.9	5	
9.0	7	
9.1	6	
9.2	6	
9.3	5	
9.4	4	
9.5	1	
9.6	1	
9.7	1	
	85	68

Hand index	Male	Female
44.0	—	1
44.5	—	1
45.0	1	—
45.5	1	3
46.0	1	5
46.5	—	5
47.0	—	7
47.5	1	6
48.0	2	5
48.5	4	4
49.0	4	6
49.5	3	1
50.0	12	6
50.5	11	5
51.0	4	6
51.5	10	3
52.0	5	1
52.5	8	2
53.0	4	1
53.5	6	
54.0	4	
54.5	1	
55.2	2	
55.5	—	
56.0	1	
	85	68

HAND-STATURE INDEX.

	Male	Female
9.6	1	
9.8	—	
10.0	4	6
10.2	9	9
10.4	14	8
10.6	10	11
10.8	13	4
11.0	17	12
11.2	3	3
11.4	4	2
11.6	2	3
11.8	—	—
12.0	—	2
12.2	—	1
12.4	—	—
12.6	—	2
12.8	1	—
13.0	1	2
13.2	—	1
Total	79	66

FOOT AND LEG MEASUREMENTS.

Left foot, length

	Male	Female
18.0	1	—
18.5	—	—
19.0	—	1
19.5	—	3
20.0	—	9
20.5	—	14
21.0	1	4
21.5	2	23
22.0	6	6
22.5	3	3
23.0	24	4
23.5	11	1
24.0	13	—
24.5	5	—
25.0	8	—
25.5	5	—
26.0	2	—
26.5	1	—
29.0	1	—
Total	83	68

Left foot, width

	Male	Female
7.0	—	1
7.5	—	—
8.0	—	17
8.5	4	22
9.0	9	23
9.5	20	5
10.0	26	—
10.5	17	—
11.0	6	—
11.5	—	—
12.0	1	—
Total	83	68

FOOT AND LEG MEASUREMENTS.

Foot index

	Male	Female
34	1	1
35	—	2
36	1	—
37	2	3
38	1	5
39	4	5
40	13	10
41	13	15
42	14	15
43	17	5
44	8	5
45	4	2
46	2	
47	1	
48		
49	1	
50		
51		
52	1	
Total	83	68

Left leg, circum. max.

	Male	Female
22.6	—	1
24.4	—	1
25.0	—	3
25.5		
26.0	—	1
26.5	1	1
27.0		
27.5		
28.0	1	—
28.5	—	1
29.0	2	1
29.5	1	2
30.0	2	2
30.5	1	1
31.0	—	4
31.5	1	2
32.0	5	1
32.5	—	2
33.0	3	2
33.5	7	—
34.0	8	1
34.5	5	3
35.0	4	2
35.5	3	—
36.0	3	3
36.5	5	2
37.0	2	2
37.5	3	1
38.0	—	1
38.5	—	1
39.0	1	3
39.5		
40.0		1
40.5		1
41.0		1
Total	58	47

FOOT AND LEG MEASUREMENTS.

Foot-stature index	Male	Female
11.8	1	
13.6	—	4
13.8	3	7
14.0	4	8
14.2	8	10
14.4	4	11
14.6	9	4
14.8	5	1
15.0	15	5
15.2	7	4
15.4	9	1
15.6	3	2
15.8	3	—

Foot-stature index	Male	Female
16.0	3	1
16.2	—	3
16.4	1	1
16.6	—	
16.8	—	
17.0	—	1
17.2	—	2
17.4	—	1
17.6	1	
17.8	2	
	78	66

Stature-leg circum. index	Male	Female
15	—	1
16	1	2
17	1	2
18	1	1
19	4	4
20	9	5
21	17	8
22	10	—
23	9	4
24	2	3
25	1	2
26	—	4
27		4
28		
29		3
30		1
31		1
	55	45

EAR MEASUREMENTS.

Height	Male	Female
5.1	1	1
5.2	1	1
5.3	2	1
5.4	—	3
5.5	2	4
5.6	5	4
5.7	4	11
5.8	4	6
5.9	6	9
6.0	8	3
6.1	7	4
6.2	6	5
6.3	4	6
6.4	8	6
6.5	1	1
6.6	9	2
6.7	2	—
6.8	4	—
6.9	4	1
7.0	—	
7.1	3	
7.2	1	
7.3	—	
7.4	1	
7.5	—	
7.6	1	
7.7	1	
	85	68

Breadth	Male	Female
3.0	1	1
3.1	—	3
3.2	2	4
3.3	1	3
3.4	6	14
3.5	6	17
3.6	6	11
3.7	11	5
3.8	10	3
3.9	16	4
4.0	10	1
4.1	6	—
4.2	8	1
4.3	1	—
4.4	—	1
4.5	1	
	85	68

Index	Male	Female
50	—	3
51	2	1
52	3	2
53	2	3
54	—	—
55	3	3
56	3	7
57	6	4
58	8	9
59	7	3
60	5	3
61	11	4
62	2	4
63	7	6
64	5	3
65	2	4
66	5	3
67	4	3
68	3	—
69	3	—
70	2	—
71	—	1
72	—	2
73	—	
74	—	
75	1	
76	—	
77	1	
	85	68

NOSE.

Nose, height to nasion?

	Male	Female
4.1	—	1
4.2		
4.6	—	1
4.7	—	1
4.8	3	5
4.9	—	5
5.0	—	2
5.1	5	6
5.2	5	7
5.3	2	4
5.4	8	8
5.5	7	10
5.6	11	8
5.7	7	2
5.8	13	2
5.9	7	2
6.0	2	2
6.1	4	—
6.2	7	—
6.3	2	1
6.4	—	1
6.7	1	—
7.0	1	—
	85	68

Nose, width max.

	Male	Female
3.0	—	1
3.1	—	2
3.2	—	1
3.3	—	3
3.4	4	8
3.5	4	10
3.6	5	11
3.7	10	11
3.8	8	7
3.9	16	5
4.0	8	2
4.1	12	2
4.2	4	2
4.3	2	1
4.4	5	1
4.5	4	—
4.6	—	1
4.7	3	—
	85	68

Nasal index?

	Male	Female
55	1	1
56	—	—
57	—	2
58	1	—
59	2	1
60	4	1
61	4	4
62	7	4
63	3	4
64	1	6
65	2	2
66	4	7
67	7	4
68	6	2
69	7	6
70	3	4
71	4	1
72	4	4
73	—	2
74	2	—
75	1	4
76	7	1
77	3	1
78	2	—
79	—	1
80	2	1
81	3	1
82	1	1
83	1	—
84	—	—
85	2	—
86	1	—
87	—	—
88	—	1
89	—	1
100	—	1
	85	68

FACE MEASUREMENTS.

Face, menton-nasion?

	Male	Female
11.2		1
11.3		—
11.4		1
11.5		—
11.6		2
11.7		—
11.8		1
11.9		1
12.0		7
12.1		2
12.2	1	7
12.3	1	5
12.4	4	4
12.5	1	1
12.6	3	7
12.7	1	3
12.8	5	3
12.9	1	—
13.0	10	2
13.1	3	2
13.2	4	1
13.3	2	1
13.4	7	5
13.5	4	1
13.6	4	1
13.7	3	—
13.8	4	1
13.9	4	2
14.0	5	2
14.1	—	2
14.2	3	—
14.3	3	—
14.4	5	—
14.5	—	—
14.6	1	—
14.7	—	—
14.8	1	1
14.9	1	—
15.0	—	—
15.1	—	—
15.2	1	1
15.3	1	
15.4	—	
15.5	—	
15.6	1	
15.7	1	
	83	67

Menton-crinion

	Male	Female
15.2		3
15.4	1	0
15.6	0	2
15.8	—	1
16.0	1	3
16.2	—	6
16.4	—	8
16.6	1	4
16.8	3	2
17.0	1	8
17.2	2	3
17.4	3	8
17.6	9	6
17.8	4	3
18.0	5	4
18.2	8	4
18.4	8	—
18.6	10	—
18.8	4	1
19.0	3	—
19.2	9	—
19.4	6	—
19.6	3	—
19.8	—	1
20.0	1	
	82	67

Height of forehead (nasion-crinion)?

	Male	Female
2.6	1	
2.7	—	
2.8	—	
2.9	1	1
3.0	—	2
3.1	1	—
3.2	1	1
3.3	1	1
3.4	1	1
3.5	—	1
3.6	—	4
3.7	1	3
3.8	—	4
3.9	1	3
4.0	2	2
4.1	—	5
4.2	3	3
4.3	5	5
4.4	4	5
4.5	3	3
4.6	4	—
4.7	4	1
4.8	5	4
4.9	5	5
5.0	8	1
5.1	2	4
5.2	8	2
5.3	5	1
5.4	6	2
5.5	1	1
5.6	1	1
5.7	2	1
5.8	1	
5.9	1	
6.0	2	
6.1	—	
6.2	1	
6.3	—	
6.4	—	
6.5	—	
6.6	1	
	82	67

FACE MEASUREMENTS.

Diam. bizygom. max.

	Male	Female
12.6		1
12.7		1
12.8		2
12.9		1
13.0	2	7
13.1	—	3
13.2	1	7
13.3	3	10
13.4	5	3
13.5	7	13
13.6	3	3
13.7	3	5
13.8	6	3
13.9	6	5
14.0	5	0
14.1	2	1
14.2	11	2
14.3	7	
14.4	4	
14.5	5	
14.6	4	
14.7	4	
14.8	3	
14.9	1	1
15.0	—	
15.1	2	
15.2	1	
	85	68

Facial index, morphologic

	Male	Female
84.0	1	
85.0	1	1
86.	—	3
87.	3	5
88.	3	4
89.	2	1
90.	6	4
91.	4	5
92.	7	5
93.	4	5
94.	7	3
95.	6	5
96.	3	4
97.	8	4
98.	5	2
99.	4	2
100.	5	3
101.	1	3
102.	4	3
103.	2	1
104.	3	1
105.	—	—
106.	1	1
107.	1	—
108.	2	—
109.	—	2
110.	1	—
117.	1	—
	85	67

Facial index, physiogmonic

	Male	Female
69	2	
70	4	
71	2	1
72	6	1
73	7	3
74	5	6
75	11	10
76	7	4
77	9	2
78	6	10
79	7	7
80	4	5
81	2	3
82	1	3
83	5	3
84	1	2
85	—	2
86	1	1
87	1	1
88	1	2
89		1
	82	67

FACE MEASUREMENTS.

Mouth width

	Male	Female
4.3		2
4.4		2
4.5	4	1
4.6	—	4
4.7	2	7
4.8	3	11
4.9	8	3
5.0	8	3
5.1	3	7
5.2	5	5

Mouth width

	Male	Female
5.3	5	5
5.4	8	7
5.5	4	2
5.6	8	5
5.7	9	—
5.8	5	2
5.9	—	1
6.0	6	—
6.1	—	—
6.2	1	1

Mouth width

	Male	Female
6.3	1	
6.4	1	
6.5	1	
6.6	1	
6.7	—	
6.8	1	
6.9	1	
	85	68

HEAD MEASUREMENTS.

Head: d. ant. post.	Male	Female
16.2		1
16.4		0
16.6		1
16.8		0
17.0		1
17.2		5
17.4		6
17.6	1	8
17.8	5	9
18.0	3	12
18.2	6	6
18.4	9	4
18.6	15	6
18.8	13	6
19.0	7	1
19.2	9	1
19.4	6	1
19.6	6	
19.8	1	
20.0	0	
20.2	1	
20.4	1	
20.6	1	
20.8	1	
	85	68

D. lateral max.	Male	Female
13.4		1
13.6		2
13.8	2	5
14.0	5	4
14.2	1	9
14.4	6	16
14.6	9	9
14.8	19	11
15.0	9	6
15.2	14	1
15.4	10	4
15.6	9	
15.8	1	
	85	68

Cephalic index	Male	Female
71	1	1
72	0	1
73	3	0
74	2	1
75	7	1
76	4	3
77	8	5
78	13	6
79	8	11
80	14	8
81	6	9
82	6	9
83	4	5
84	6	2
85	3	2
86		2
87		1
88		0
89		0
90		1
	85	68

HEAD MEASUREMENTS.

Height-line between auditory meati to bregma.

	Male	Female
12.1	1	
12.2	1	
12.3	1	
12.4	0	1
12.5	1	2
12.6	1	5
12.7	0	7
12.8	1	6
12.9	6	8
13.0	6	5
13.1	5	6
13.2	11	8
13.3	3	7
13.4	6	3
13.5	14	3
13.6	3	1
13.7	4	2
13.8	7	3
13.9	7	1
14.0	2	
14.1	2	
14.2	0	
14.3	0	
14.4	1	
14.5	1	
14.6	0	
14.7	1	
	85	68

Cephalic module

	Male	Female
14.6		8
14.8	1	10
15.0	3	15
15.2	12	18
15.4	12	9
15.6	18	6
15.8	17	1
16.0	13	1
16.2	6	
16.4	0	
16.6	2	
16.8	1	
	85	68

Cephalic module vs. height

	Male	Female
86	1	
88	1	
90	2	1
92	4	0
94	7	2
96	12	4
98	21	9
100	7	11
102	11	8
104	6	9
106	2	6
108	2	3
110	0	2
112	0	2
114	1	1
116	0	3
118	0	1
120	0	3
122	1	1
124	1	
	79	66

HEAD MEASUREMENTS.

Head-height index

	Male	Female
62	2	
63	0	
64	0	
65	1	
66	2	
67	3	4
68	9	2
69	12	3
70	20	12
71	7	11
72	9	9
73	7	9
74	7	7
75	2	4
76	2	2
77	1	1
78	1	0
79		2
80		2
	85	68

PART II.

MACHIGANGA INDIANS OF THE SAN MIGUEL VALLEY.

General Considerations.

The Machigangas are a group of Indians living in the general region of the San Miguel River, one of the streams assisting in the formation of the Amazon, at an altitude of some 3,000 feet, which is considerably less than that of the region occupied by the Quichua who were measured.

The Machigangas are quite uncivilized, living, however, in small groups in thatched huts. The extent of their distribution was not investigated.

The following quotation from Dr. Ford's report indicates in a general way some of their characters and customs.

"At 7.15 a bunch of Machigangas came into camp and crowded around our breakfast table. They are friendly, curious and somewhat timid. The men have strong, broad faces with high cheek bones and shallow broad noses. The hair is long, thick, dull black and fine. All have red grease paint streaked on faces in varied designs. Though this paint seems to be applied only to the face it becomes smeared over everything, hands, garment and hair. The women are full chested and broad hipped. The men are all thin, broad shouldered and finely muscled. All have small, slender hands and feet, small wrists and ankles. Nails are all well shaped and clipped. All wear the same kind of garment. It is a shirt of heavy, well-woven cloth originally white with a small, black stripe but in use universally red from the paint. Some have narrow woven bands on the wrists and ankles and the women bands of the same just below the knee. The shirts are often decorated with bunches of nuts, bones, teeth, etc. Many have necklaces of nuts and seeds. Bags woven of cotton are hung around their necks for coca and other things. Some of the men have coils of cord hung over neck and shoulders. This cord is said to be used to climb trees and as extra bow strings. The children are thin, but very active, happy and full of play. The men are very talkative and their voices are musical and low-pitched. . . . The Indians chew much coca, both men and women sharing their chews with the children. They do not paint around the mouth or on the chin and seldom on the forehead. A stripe or two down the nose is very common and sometimes there is one across the bridge. The women appear to be very modest. Though they do not object to measurement of their calves, they see that their garment does not get above the knee. They are indifferent as to the exposure of their breasts. The eyelashes are longer than those of the average white woman. There is no odor about the person. . . . Pinto (overo, a parasitic skin disease) is very common, both the dark and light varieties, on the hands and feet. One man had a woven cotton head band with short feathers. Women have bunches of nuts, seeds, bones and bright bird heads hung on their ponchos. Their teeth are poor and gums are retracted and filthy. . . . The Machigangas live a few in each clearing in palm thatched huts. They raise yuccas, tobacco and cotton in a very small way. . . . Six men, five women and several children live at this clearing called Pancochi. Most of the men are away hunting. The village consists of one large building and four small shelters, including a very neat hen-coop. Everything is of Saga palm. The main hut is thirty feet by twenty feet and twelve feet high. The walls are only two and one-half feet, with a long rounded slope to the ridge. . . . The huts are very cool and clean inside. Mats of woven palm leaves gave comfortable seats. To the roof were hung baskets, nuts and gourd bottles with corks of corn cobs. Bunches of arrows of various sizes and design were stuck in behind the rafters. Bundles of reeds for arrow shafts, sticks of cariri palm and bunches of feathers were stored in various places. On one side was a group of ollas of black, hard pottery, very crudely made. . . . The chief gave us a demonstration with his bow and arrows. He could keep an arrow up in the air for seven seconds. He brought one down unpleasantly close to us and it stuck five inches into the hard baked ground. At fifty feet he shot twice at an eight-inch gourd, striking it once. They all enjoyed posing. One lady was much 'peeved' because I could not include her in a group. . . . They have no form of writing or communication by pictures; no painting on mats or pots. Some of their gourd utensils are decorated with carved lines and I have seen some crude carving on slabs of bone and nuts. They make fire with fire stick and cotton fibre. They see some good influence or something to revere—a good Spirit—in the sun, but 'Bad Spirits' in nearly everything. They have no regular feast days. The marriage ceremony is very simple, and seems mostly an excuse for a dance and chicha drinking. . . . Men never have more than three wives, usually only one and seldom change. There is an average of four children to each woman. Infant mortality is high. The age of marriage is not known, physical development is chiefly considered. They have no idea of time except the day and month; no year or record of time and cannot count beyond three. The women spin cotton and weave bags, wristbands and shirts and make nets, also mats of palm leaves. The men make bows and arrows and hunt, also catch fish in traps. They raise yuccas, corn, coffee, cotton, pineapples and bananas, and build their huts.

They have Pan pipes, fifes, drums and rattles. They keep for pets parrots, monkeys and domestic birds resembling large guinea fowls.

They are active and quick to learn simple things and play and joke among themselves. . . . They have names for two diseases, or two names for ailments. . . . *Marinchi*—a fever, sore throat, coated tongue, thick mucus from nose, and cough, with recovery in three or four days. This disease is very contagious and fatal and affects all ages. The second disease is *Manchigarinchi*, showing fever, diarrhoea, headache and vomiting. . . .

This evening the old gentleman sat by the fire with one of the girls, about ten years old, squatted opposite and together played on small Pan pipes. It is curious music, nearly all of the notes are of the same length with much accent and three-fourths time mostly.

The following are a few Machiganga words spelled phonetically according to the Spanish pronunciation:—

man—*cerare*
woman—*huayua*
father—*apá*
mother—*cná*
boy—*noctome*
girl—*nociendo*
house—*pancoche*

come—*tyena*
money—*sorrochi*
fire—*chichi*
pipe—*sungachi*
tobacco—*tobaco* (Spanish)
hair—. . . . .
head—*noquiti*

water—*mia*
milk—*ichome*
breast with milk—*nochome*
tree—*inchato*
night—*chistineri*
day—*poriaqui*
month—*cashiri*
moon—*cashiri*
sun—*porridachi*
star—. . . . .
clouds—*mingori*
iron—*ascrro* (Spanish?)
one—*partiro*
two—*piteni*
three—*mawani*
dead—*camaiqui*
small—*magatinchi*
man or woman who knows how to give medicine—*eveúquiqui*
ear—*chiúpita*
eye—*nocqui*
mouth—. . . . .
hand—*naco*
foot—*pigiti*
knee—*ingierto*
salt—*tibi*
shirt—*unco*
arrow—*chacopi*
bow—*piarinqui*
mountain—*inginichiqui*
river—*niaca*
devil—*camagorinti*
today—*mayica*
tomorrow—*camanci*
trail—*abochi*
no—*maní*
yes—*ch-ch*

There seem to be no plural forms, no distinctive personal names and no words of greeting or farewell. . . .

While the food of the Indians consists largely of fruits, they also eat flesh and fish and even grubs. They chew coca extensively and have a habit of using the juice of burned tobacco held in a cane joint which they apply to the edges of the tongue and the gums."

Among the pathological conditions treated by Dr. Ford are malnutrition, ant bites, oriental sore, malaria, conjunctivitis and heart lesions.

The Indians believe that oriental sore is caused by the bite of a spider and claim to have a remedy in the bark of a certain kind of tree.

Most of them are pock-marked, perhaps eight out of ten having had small pox.

Inspection.

The eye color was dark brown and the conjunctiva yellowish in all individuals of both sexes. The *inner canthus* was slightly lower than the external in all instances.

The *supraorbital ridges* were medium or slightly above medium development in all cases of both sexes, being pronounced in none.

The *forehead* was medium in height in 77.8% of the males and 80% of the females and above medium in 22.2% of the males and 20% of the females. The inclination and breadth of forehead were not noted.

Alveolar prognathism was medium in 77.8% of the males and in all the females, above medium in 22.2%. The *chin* was medium in projection in 66.7% of the males and 60% of the females, submedium in 33.3% of both males and females, supramedium in 6.7% of females.

The *malars* showed pronounced projection in 88.9% of the males and 93.3% of the females, medium in 5.5% of the males, and supramedium in 5.6% of the males and 6.7% of the females.

The *lips* were medium in thickness in 44.4% of the males and 60% of the females, above medium in 55.6% of the males and 40% of the females. No observations were recorded as to procheily or orthocheily.

The *angle* of the *lower jaw* was medium in 33.3% of the males and 20% of the females, pronounced in 66.7% of the males and 80% of the females.

The skin in the males was medium or red brown in equal proportion while in the females there was a preponderance of the medium brown.

The hair was a rusty dull black in all individuals of both sexes. It was straight in all of the females and 83.3% of the males, in the rest the hair was wavy. None of either sex showed any gray scalp hair, and while none of the females showed any loss of the hair, 11.1% of the males had slight alopecia.

The hair of the moustache and beard was black and scanty in all cases and absent in 22.2%. One only showed a few gray hairs.

The breasts were conical in 80% of the females and flat at 20%.

The *hand pressure* recorded by the dynamometer showed an average in the males of 21.9 for the right hand, the greatest being 33, and 21.3 for the left, the greatest being 38. For the females the average for the right hand is 12.8, the greatest being 22; for the left hand the average is 10.4, the greatest being 15. These records are slightly less than for the Quichua.

No observations were made of temperature, pulse or respiration. The only pathological conditions recorded were a case of ant bites and two instances of slight jaundice.

STATURE SPAN AND INDICES.

Eighteen males and fifteen females were measured. The average height for the male is 1559 mm., the tallest was 1627 and the shortest 1505, giving a variation range of 122. The Machiganga therefore belong to Topinard's "Low Stature" group and are shorter than the Quichua (1583).

The female Machiganga shows an average height of 1439 mm., which is somewhat less than that of the Quichua female (1454), with extremes of 1530 and 1153, and a variation range of 377. This is an average difference in favor of the male of 120 mm., which is the same as the sex difference in the Quichua (120). The much greater variation range in the female than in the male is probably incident to the small number of individuals measured, as no similar sex difference was noted in the Quichua and has not been described in other races.

The seriation table of heights shows that 89% belong to the low stature group, 11% are of medium stature and none belong to Topinard's "tall group" above 1700 in height. But the number of individuals included is too small to give definite results. The Machiganga is of about the same height as the Igorot (1549, Bean) and the Laplander (1558, Anutschin) and the Labrador Eskimo (1552, Hrdlička). At the end of the article will be found tables giving the various measurements, the averages, extremes, ranges of variation, and seriation lists.

The greatest span in 18 males was 1635 mm., the least 1454, with a variation range of 181 and an average of 1559. The span shows a greater variation range than the height (122). In the 15 females the greatest span was 1521, the least 1138, the variation range 383 and the average 1424. Here again as in the height the variation range is considerably greater in the female than in the male.

The former expedition found that in the male Quichua the average span was 1621. The span on the average was greater than the height by 36, the greatest excess of span over height was 117, the greatest excess of height over span was 102 mm.

In the Machiganga male the average span is equal to the average height. The greatest excess of span is 60 millimeters and the greatest excess of height was 86 mm. In the female the span is 15 mm. less than the height on the average. The greatest excess of span is 102 and the greatest excess of stature 99 mm., and the females (201) show a greater range variation than the male (146).

The span-stature index $\left(\frac{\text{span x 100}}{\text{stature}}\right)$ gives an average of 100. for the male and 99.9 for the females. This index shows in another way the relation of the stature to the span which has already been illustrated in the discussion of the excess of span over height. The male Quichua shows an index somewhat greater (102.3) than the Machiganga, and of the various races only the Polar Eskimo (99.3) and the Colorado Indian seem to have as low an index as the Machiganga.

The seriation table shows that 44.4% of male Machigangas have an index between 100.5 and 102., while only 13.3% of the females are found here, 46.6% being between 98.5 and 100.

Sitting Height.

The average sitting height in the male is 78.1 mm., the extremes 857 and 676, and the variation range is 181. In the females the average sitting height is 742, the extremes 845 and 696, and the variation range 149.

Both the sitting height and the variation range are less in the female than in the male and the range in the male varies more than that of the stature, contrary to what is usually true. In the Quichua the variation range in the stature was greater in both sexes and due to the fact that the length of the lower extremities is more variable than the body length.

In the male the stature-sitting height index averages 50.09, the greatest 52.67, the least 43.73, and the variation range 8.94. In the female the average is 51.79, the extremes 66.09 and 47.15, and the variation range 18.9. The variation range is large in the male and surprisingly larger in the female, as compared with the Quichua and other races in which, while the average index is regularly higher in the female, the variation range is less. The Machigangas have a lower index than most races, i. e., their bodies are short and legs long. Hrdlička gives the average for 20 American negroes as 51.4. No senile cases were measured. There were no measurements taken of the arm, forearm, leg or thigh.

Hands.

The length of the hand is measured from the midpoint of a line tangent to the proximal edge of the thenar and hypothenar eminences to the tip of the middle finger. The breadth is the greatest distance from the angle between the thumb and forefinger to the ulnar side of the hand at right angles to the line representing the length. The left hand only was measured, in 18 males and 15 females.

The length of the hand averages in the male 164, the extremes are 183 and 151, and the range of variation 32. In the female the average length is 155, the extremes 168 and 142, and the variation range is 26.

The breadth of the hand in the male averages 81, the extremes are 90 and 74, and the variation range 16. In the female the breadth averages 74, the extremes are 81 and 69, and the variation range 12. Thus the hand of the female is less in all dimensions than that of the male, as is also the variation range.

The hand of the Machiganga is smaller in both dimensions than the hand of the Quichua (171 and 88).

The hand index in the male averages 49.3, with extremes of 54.3 and 45.9, and a variation range of 8.4. In the females the average is 47.4, the extremes are 50.7 and 44.8, and the variation range 5.9. This index is somewhat larger in the Quichua (51.3♂ and 48.8♀) and is similarly smaller in the female than in the male.

The hand module $\left(\frac{L+B}{2}\right)$ averages in the male 12.3, in the female 11.5.

The relative hand length to stature in the male averages 10.5, with extremes of 11.5 and 9.5, and a variation range of 2. In the female the average is 10.7, the extremes 12.3 and 10.1, and the variation range 2.2. This is quite similar to the index of the Quichua (10.8) in the male but much smaller than in the Quichua female (12.5).

Tables in seriation in the appendix indicate the distribution of these various measurements and indices. While the hand index is large in the male, the hand-stature index is smaller than in the female.

Thorax.

The chest measurements were made at the nipple level in median expansion. The average lateral diameter in the male is 275, with extremes of 306 and 256, and a range of variation of 50. In the female the average lateral diameter is 262, with extremes of 278 and 242, and a range of variation of 36. The antero-posterior diameter in the male gives an average of 218, with extremes of 249 and 188, and a range of variation of 61. In the female this diameter averages 208, with extremes of 244 and 186, and a variation range of 58. Both of these diameters are greater in the Quichua who live in the mountains at a higher altitude breathing more rarefied air.

The thoracic index in the male averages 79.4, with extremes of 85. and 71.2, and a variation range of 13.8. In the female this index averages 79.3, with extremes of 92.5 and 69.8, and a variation range of 22.7. This index is high in both sexes in comparison with other races.

Foot.

The length and breadth of the left foot were taken by the same methods as used in the case of the Quichua. The average length for the male is 229, the extremes 245 and 216, and the range of variation 29. In the female the length averages 206, the extremes are 219 and 184, and the variation 35. The width in the male averages 96, the extremes are 114 and 84, and the variation range 30. In the female the width averages 85, the extremes are 97 and 80, and the variation range 17.

The dimensions of the female foot are distinctly less than those of the male, the longest female foot is barely longer than the shortest male foot and the foot dimensions are less in both sexes than in the Quichua.

The foot modulus $\left(\frac{L+B}{2}\right)$ averages for the male 162 and for the female 145.

The average foot index for the male is 41.8, the extremes are 48.5 and 36.2, with a variation range of 12.3. In the female the index averages 41.05, with extremes of 44.3 and 38.5, and a variation range of 5.8.

The stature-foot index in the male averages 14.63, with extremes of 15.5 and 13.9, and a variation range of 1.6. In the female the average index is 14.34, with extremes of 16.0 and 13.2, and a range variation of 2.8. This shows that the foot is relatively smaller in the female as well as absolutely and constitutes a noteworthy secondary sex character.

Leg Circumference.

The maximum circumference of the left leg in the male is 323.5, with extremes of 365 and 289, and a range variation of 76. In the female the average is 309, with extremes of 340 and 267, and a range variation of 73. This measurement is absolutely larger in the male but the variation range is similar in the two sexes. Hrdlička found the average in American negroes to be 369, in American Indians 340, and in white men 360. In the Quichua male this measurement averages 341 and in the female 331.

The stature-leg circumference index averages in the male 20.7, with extremes of 23.4 and 18.4, and a range variation of 5.0. In the female the average is 21.55, the extremes are 26.97 and 18.01, and the variation range 5.52. This shows that while the maximum calf circumference in the female is absolutely smaller than in the male it is relatively to the stature greater. It is less in both sexes than for the Quichua.

Face Measurements and Indices.

The average face height (menton-nasion) in the male is 125, the extremes are 133 and 166, and the variation range is 17. In the female the average is 116, the extremes are 124 and 109, and the variation range 15. It is probable that the nasion has been placed too high here in making the measurements, as seemed to be true also in the case of the Quichua. The morphologic face height is believed to increase to a slight extent with age, but of course decreases with marked wearing of the teeth and the edentulous condition. These dental factors were not operative in any of the Machigangas measured.

The face breadth (bizygomatic) averages in the male 14.1, the extremes are 150 and 135, and the variation range 15. In the female the average diameter is 133.5, the extremes 141 and 126, and the variation range 15. The Quichua and Machiganga are quite similar in this measurement, which is large in comparison with that of other races.

The menton-crinion measurement gives the physiognomic face height. In the male this averages 178, with extremes of 192 and 167, and a variation range of 25. In the female the average is

166, the extremes are 176 and 156, and the variation range 20. This height is less in the Machiganga of both sexes than in the Quichua.

The forehead height averages in the male 53, the extremes are 65 and 34, with a variation range of 31. In the female the average is 50, the extremes are 61 and 36, with a variation range of 25. The height of the forehead is distinctly less in the Machigangas than in most races, both white and black, and the range of variation is surprisingly large.

Slight alopecia was present in a few of the individuals measured.

The cephalometric morphologic facial index

$$\left(\frac{\text{menton to nasion x 100}}{\text{bizygomatic breadth}}\right)$$

averages in the male 88.4, with extremes of 95.7 and 81.1, and a variation range of 14.6. In the female the average index is 87.1, the extremes 94.6 and 77.3, and the variation range 17.3. The physiognomic index $\left(\frac{\text{bizygomatic diameter x 100}}{\text{menton to crinion}}\right)$ in the male averages 79.3, with extremes of 85.1 and 72.1, and a variation range of 13.0. In the female the average is 80.3, with extremes of 86.8 and 74.3, and a variation range of 12.5.

The stature-face height index in the male averages for the morphologic height 8.0, for both male and female, and for the physiognomic height 11.4 for the male and 11.5 for the female.

From the seriation table it can be seen that of the Machiganga 11.1% of the males and 26.7% of the females are euryprosopic (–83.9), 33.3% males and 26.7% females mesoprosopic (84.–87.9), 50% males and 33.3% females leptoprosopic (88.–92.9), and 5.6% males and 13.3% females hyperleptoprosopic (93–). This classification is probably somewhat erroneous, due to placing the nasion too high in making the face height measurement, so that a comparison with the Quichua and other races would be misleading.

On account of the small number of individuals it will not be profitable to attempt an analysis of the relation of face form to the head measurements and form, although the same thing is probably true here as in other groups, viz., that face height is more correlated with the head length than with the height, cephalic index or module.

Nasal Measurements and Indices.

The height of the nose was measured from the site of the nasion to the site of the subnasal point, the breadth from the lower border of one ala to the opposite symmetrical point.

The average height in the male is 50, the extremes 58 and 43, and the variation range 15. The breadth averages 42, the extremes 49 and 37, and the variation 12. In the female the average height is 46, the extremes 52 and 38, and the variation range 14. The breadth averages 38, the extremes 46 and 33, and the variation range 13. The nose height is less than in the female and is less in the Machiganga than in the Quichua (57♂, 53♀). There is a general relation of the nasal dimensions to the facial, i. e., a long nose accompanies a long face and a broad nose a broad face.

The physiognomic nasal index in the male averages 85.4, with 111.4 and 68.4 as extremes, and a range of variation of 42.9. In the female the average is 86.6, with extremes of 97.37, and a range of variation of 28.62. The average nose is chamaerrhine in the male but mesorrhine in the female. This index in the Machiganga is nearly the same for both sexes but with a smaller variation range in the female and is larger than in the Quichua. The seriation table shows that 5.6% of the males and 6.7% of the females are leptorrhine (55–69.9), 50% of the males and 60% of the females are mesorrhine (70–84.9), 33.3% of the males and females are chamaerrhine (85–99.9), and 11.1% of males are hyperchamaerrhine (100–).

By inspection the dorsum of the nose in the male is found to be straight in 11.1%, in the female in 26.7%; convex in the male in 16.7%, in the female in 20%; slightly convex in the male in 66.7%, in the female 33.3%; and concave in the male in 5.5% and slightly concave in 20% of the females. The convex nose is the predominant form in both sexes of the Machiganga while the straight and sinuous nose is most frequently found in the Quichua.

The nasal depression is "shallow" in all of the males and females, according to the records. An inspection of the photographs, however, would lead us to believe that there had been a misinterpretation of the term "shallow" as applied to the nasal root, which is certainly markedly depressed in many of the Machiganga.

The base of the nasal septum is horizontal in 22.2% of the males and 6.7% of the females, inclined up in 72% of the males and 73.3% of the females; inclined down in 5.6% of males and 20% of females.

The nose of the male is higher, wider and more frequently convex than that of the female, the nasal depression is equally marked in the two sexes and the inclination of the base and nasal index are about the same.

Ear.

The left ear only was measured, and the method of measurement was the same as in the case of the Quichua.

The average ear height in the male is 62, the extremes 71 and 55, and the range of variation 16. In the female the average is 59, the extremes 74 and 54, and the variation range 20. In the male the breadth averages 38, the extremes are 49 and 34, and the range of variation 16. In the female the average breadth is 36, the extremes are 39 and 33, and the range of variation 6.

The ear of the female is smaller than that of the male in both dimensions and also the extent of variability is less. The ear of the Machiganga is very similar in its dimensions and form to that of the Quichua.

The height or physiognomic length of the ear varies racially from 49.0 in the Hottentot to 75 in the Patagonian (Schwalbe), and in the Machiganga is larger than in the negro (59.9 ♂ Hrdlička), smaller than in the North American Indian (67.6 ♂ Hrdlička), and about the same as in the Japanese, 62.0, and Northern Chinese (61.0 ♂ Hrdlička).

The breadth is slightly greater than that of the American negro (36.9 ♂ Hrdlička) and almost the same as in the North American Indian (38.7 ♂ Hrdlička).

The physiognomic ear index averages 61.86 in the male, the extremes are 83.1 and 55.4, and the variation range 27.7. In the female this index averages 60.7, the extremes are 67.3 and 45.9, and the variation range is 21.4. As indicated by this index the female ear is a little more slender than the ear of the male, as is also true in the Quichua, where the index is very similar to that of the Machiganga in both sexes. There is no mention of ear anomalies.

The following table shows the grouping of the Machiganga according to ear index:—

Index	Class	Machiganga ♂	Machiganga ♀
(–54.9)	Hypermicrotic	——	6.7 per cent
(55–59.9)	Microtic	33.3 per cent	26.7 per cent
(60–64.9)	Mesotic	55.6 per cent	53.3 per cent
(65–)	Macrotic	11.1 per cent	13.3 per cent

The modulus of the ear is the mean of the two dimensions $\left(\frac{H+B}{2}\right)$ The average ear modulus in the Machiganga male is 50, in the female 47.5. In the negro it is 48.4 (Hrdlička), and in the North American Indian 53 (Hrdlička).

The ear is believed to be larger in tall people and to increase in dimensions with stature and age, the height increasing relatively more than the breadth, so that while the modulus increases with age the index decreases. An analysis of these relations in the Machiganga will not be profitable on account of the few individuals measured.

Head.

The head measurements were made on 18 males and 15 females, by the methods already described for the Quichua.

The greatest head length for the male averages 18.1, the extremes are 18.8 and 17.2, and the variation range 1.6. In the female the average head length is 17.3, the extremes are 18.3 and 16.8, and the variation range 1.5. The maximum width of the head in the male averages 14.5, with extremes of 15.6 and 13.7, and a variation range of 19. In the female this dimension averages 14.1, with extremes of 15.0 and 13.3, and a variation range of 1.7. The head height (meatal-bregma) in the male averages 12.8, the extremes are 13.4 and 12.0, and the variation range 1.4. In the female the average height is 12.8, the extremes 13.0 and 12.5, and the variation range 0.5.

It is seen that all of the dimensions of the head are smaller in the female except the height while the variation range is about the same except in head height where it is distinctly less in the female.

The head measurements in the Machiganga male are all smaller than in the Quichua with the exception of the height, which averages 6 mm. greater. In the female the head measurements are less than in the Quichua although the head height nearly equals that of the Quichua female.

The cephalic modulus in the male averages 15.16, with extremes of 15.67 and 14.63, and a range variation of 1.04. In the female the average modulus is 14.75, the extremes 15.13 and 14.47, and the range of variation .66. The cephalic module is less in the female than in the male and less in both sexes than in the Quichua (15.76♂, 15.20♀) or North American Indians (15.7♂).

Head Indices.

The cephalic index in the male averages 80.38, the extremes are 86.67 and 73.66, and the variation range 13.01. In the female this index averages 81.36, the extremes are 86.21 and 76.88, and the variation range 9.33.

The average cephalic index in the male barely places the Machiganga in the mesaticephalic group (76–80.9), while the female is brachycephalic (80–). A survey of the seriation tables show that of the males 61.1% are mesaticephalic, 11.1% are dolichocephalic, and 27.8% are brachycephalic. In the case of the females 46.7% are mesaticephalic and 53.3% are brachycephalic, none being dolichocephalic. The majority of heads lie near the border line of the mesaticephalic and brachycephalic group, but nearly twice as many females than males are brachycephalic.

In the male the head height-length index averages 70.93, the extremes are 75.1 and 64.1, and the variation range is 11.0. In the female the average index is 73.84, the extremes are 76.1 and 70.4, and the variation range 5.7. In the Machiganga as in the Quichua female the head is relatively high in relation to its length as compared with the male and the index is nearly the same in the two groups. The seriation table shows that all of the males and females are hypsicephalic. The Machigangas are even more markedly hypsicephalic than the Quichua.

The average head height-breadth index in the male is 88.3, in the female 90.8. This is about the same as that of the Quichua and is high as compared with that of most races (75.3 to 97.5 Martin).

The cephalic module-stature index in the male averages 97.3, with extremes of 102.1 and 93.9, and a variation range of 8.2. In the female this index averages 102.8, the extremes are 103.6

and 98.0, and the variation range 5.6. The Machiganga male, with an average stature of 155.9, has an average module index of 97.3, while the female, with average height of 143.9, has an average module index of 102.8. The average for the female is higher than for the male, as was true also of the Quichua, chiefly because of the shorter stature of the female. This index for the North American Indian ♂ is given at 95.1 (Hrdlička). As was true for the Quichua, so also in the case of the Machiganga the taller individual has a larger head absolutely but not relatively.

Cranial Capacity and Brain Weight.

If we use the Lee-Pearson formula for determining the cranial capacity in the living male (.000337 (l–11) (b–11) (h–11) + 406.01) we obtain 1304.2 cc. as the average capacity for the Machiganga.

For the female (.000400 (l–11) (b–11) (h–11) + 206.6) the average cranial capacity is 1192.2.

Multiplying the cranial capacity in cubic centimeters by .87 (Manouvrier) we obtain for the male brain weight 1134.6 grams and for the female 1037.2 grams.

The Machiganga, then, belong to the microcephalic group (–1350 cc.).

If the brain weight be estimated for the male from the stature in centimeters (stature x 7) we obtain for the male 1091.3 grams and for the female $\left(\text{stature} \times 7 \times \frac{30}{31}\right)$ 974.90 grams.

Using Gladstone's method of estimating the brain weight, which holds true between 20 and 46 years of age

$$\text{weight in grams} = \left)\frac{\text{L x B x H (auricular) in centimeters}}{2.806}\right)$$

we obtain for the Machiganga male 1197.2 grams and for the female 1112.7 grams.

No records of actual brain weight or body weight for the Machiganga are known to the writer. The various methods of determining the brain weight in the living, while they give somewhat differing results, all show that the female brain is less in weight than the male brain. The Machiganga brain is smaller than that of the negro (1245) and North American Indian (1265) or Quichua (1250.5).

Summary.

Eighteen males and fifteen females were measured and photographed.

The skin is medium or red brown (paint?) in the males and mostly medium brown in the females. In both sexes the face is streaked with red paint.

The hair is a rusty dull black, in most cases straight, but in a few males slightly wavy.

Alopecia is infrequent, gray hair is rarely observed, and the moustache and beard are scanty or absent.

The eyes are dark brown and the conjunctivae yellowish in both sexes. The palpebral fissures are slightly inclined upward at the outer end. The forehead is of medium height, the supraorbital region of medium development, the jaws and chin are medium in projection and the lips medium in thickness and protrusion. The face is broad and the malars are prominent in both sexes.

The ear is medium in size and mesotic or microtic in most individuals of both sexes.

The dorsum of the nose is generally convex in the male but less frequently in the female, the nasal root is markedly depressed in many of both sexes, and the base inclined up in the majority of cases. The nose is chiefly mesorrhine or chamaerrhine.

The Machiganga are of "low stature" (1559♂) and somewhat shorter than the Quichua, the height of the female being 120 millimeters less than that of the male. The span and height are equal, in the male; the span slightly less in the female. Their bodies are short and lower extremities long. The hands and feet are small and somewhat slender, especially in the female. The handgrip is weak and less than in the Quichua.

The stature-leg circumference index is smaller than in the Quichua and is larger in the female than the male.

The thoracic diameters are less than in the Quichua and the index is considerably larger (79.4♂ and 79.3♀), showing that the Machiganga are relatively narrow chested.

The head diameters, with the exception of the height and the modulus, are small in comparison with those of the Quichua and of most other races. All the diameters are smaller in the female, except the height, which is the same in both sexes.

While the majority of the males are mesaticephalic they are close to brachycephaly and more than one-half of the females are brachycephalic.

All individuals of both sexes were hypsicephalic and more markedly than the Quichua.

The Machiganga are microcephalic (1304 cc. ♂, 1192 cc. ♀) with a brain weight of 1091 grams for the male and 974.8 for the female, and therefore distinctly smaller than in the Quichua.

No other measurements of these Indians are known to the writer.

TABLE OF AVERAGES AND EXTREMES.

MACHIGANGA.

BODY MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Height	155.9	162.7	201	150.5	225	12.2
Max. finger reach	155.9	163.5	201	145.4	225	18.1
Excess of finger reach over height	0.0	6.0	205	−8.6	226	14.6
Height-span index	99.99	103.9	205	94.7	226	9.2
Sitting height	78.1	85.7	201	67.6	203	18.1
Stature-sitting height index	50.09	52.67	201	43.73	203	8.94

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Height	143.9	153.0	214	115.3	215	37.7
Max. finger reach	142.4	152.1	214, 220	113.8	215	38.3
Excess of finger reach over height	−1.5	10.2	220	−9.9	231	20.1
Height-span index	98.99	107.2	220	93.3	231	13.9
Sitting height	74.2	84.5	214	69.6	212	14.9
Stature-sitting height index	51.79	66.09	215	47.15	212	18.94

CHEST MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Chest, d. lateral	27.5	30.6	207	25.6	225	5.0
Chest, d. ant. post.	21.8	24.9	208	18.8	233	6.1
Chest index	79.38	85.05	203	71.21	233	13.84

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Chest, d. lateral	26.2	27.8	216	24.2	232	3.6
Chest, d. ant. post	20.8	24.4	212	18.6	213	5.8
Chest index	79.31	92.55	220	69.78	216	22.77

HAND MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Left hand, length	16.4	18.3	207	15.1	204	3.2
Left hand, width	8.1	9.0	201	7.4	227	1.6
Hand index	49.3	54.3	224	45.9	207	8.4
Stature-hand index	10.5	11.5	207	9.5	204	2.

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Left hand, length	15.5	16.8	220	14.2	215	2.6
Left hand, width	7.4	8.1	214	6.9	210, 211, 227	1.2
Hand index	47.4	50.7	215	44.8	211	5.9
Stature-hand index	10.7	12.3	215	10.1	228	2.2

HAND PRESSURE.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Right	21.9	33	207	11	233	22
Left	21.3	38	207	9	233	29

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Right	12.8	22	214	7	215	15
Left	10.4	15	209	6	215	9

FOOT AND LEG MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Left foot, length	22.9	24.5	201	21.6	203, 205	2.9
Left foot, width	9.6	11.4	208	8.4	206	3.0
Foot index	41.8	48.5	208	36.2	206	12.3
Left leg circum. max.	32.35	36.5	208	28.9	205	7.6
Stature-foot index	14.63	15.5	233	13.9	203	1.6
Stature-leg circ. index	20.7	23.4	208	18.4	204	5.0

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Left foot, length	20.6	21.9	214	18.4	215	3.5
Left foot, width	8.5	9.7	214	8.0	215	1.7
Foot index	41.05	44.3	214	38.5	220	5.8
Left leg circum. max.	30.9	34.0	214	26.7	211	7.3
Stature-foot index	14.34	16.0	215	13.2	231	2.8
Stature-leg circ. index	21.55	26.97	215	18.01	211	5.52

NOSE MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Nose, height to nasion?	5.0	5.8	204	4.3	218	1.5
Nose, width max.	4.2	4.9	201	3.7	225	1.2
Nasal index?	85.37	111.36	201	68.42	206	42.94

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Nose, height to nasion?	4.6	5.2	220	3.8	221	1.4
Nose, width max.	3.8	4.6	220	3.3	215	1.3
Nasal index?	83.62	97.37	221	68.75	215	28.62

LEFT EAR MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Height	6.2	7.1	201	5.5	225	1.6
Breadth	3.8	4.9	208	3.4	223, 225	1.5
Index	61.86	83.1	208	55.4	224	27.7

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Height	5.9	7.4	220	5.4	217, 232	2.0
Breadth	3.6	3.9	221	3.3	227	0.6
Index	60.7	67.3	210	45.9	220	21.4

FACE MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Face: Menton-nasion?	12.5	13.3	207, 233	11.6	202	1.7
Menton-crinion	17.8	19.2	224	16.7	233	2.5
Nasion-crinion?	5.3	6.5	205	3.4	233	3.1
D. bizygom. max.	14.1	15.0	201	13.5	225	1.5
Facial index, morph.?	88.4	95.7	233	81.1	208	14.6
Facial index, physiognomic	79.3	85.1	208	72.1	205	13.0
Mouth breadth	5.8	6.6	201	5.1	206	1.5

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
Face: Menton-nasion?	11.6	12.4	220	10.9	214	1.5
Menton-crinion	16.6	17.6	220	15.6	215, 216	2.0
Nasion-crinion?	5.0	6.1	212	3.6	228	2.5
D. bizygom. max.	13.35	14.1	214	12.6	210	1.5
Facial index, morph.?	87.1	94.6	231	77.3	214	17.3
Facial index, physiognomic	80.3	86.8	209	74.3	231	12.5
Mouth breadth	5.3	6.0	213	4.4	210	1.6

HEAD MEASUREMENTS.

MALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
D. ant. posterior	18.1	18.8	205	17.2	206, 223	1.6
D. lateral max.	14.5	15.6	224	13.7	219	1.9
Cephalic index	80.38	86.67	224	73.66	219	13.01
Height line between auditory meati to bregma	12.8	13.4	224	12.0	204	1.4
Cephalic module	15.16	15.67	224	14.63	206	1.04
Ceph. mod.—stature	97.3	102.1	225	93.9	202	8.2
Head-height index	70.9	75.1	233	64.1	204	11.0

FEMALES.

	Average	Greatest	Serial No.	Least	Serial No.	Range of variation
D. ant. posterior	17.3	18.3	214	16.8	210, 215	1.5
D. lateral max.	14.1	15.0	211	13.3	212	1.7
Cephalic index	81.36	86.21	211	76.88	212	9.33
Height line between auditory meati to bregma	12.8	13.0	216, 228	12.5	217, 227	0.5
Cephalic module	14.75	15.13	214	14.47	210, 212, 217	0.66
Ceph. mod.—stature	102.8	103.6	216	98.0	212	5.6
Head-height index	73.84	76.1	210	70.4	214	5.7

SERIATION TABLE.

MACHIGANGA.

BODY MEASUREMENTS.

Height	Male	Female
114	—	1
140		2
142		2
144		3
146		3
148		2
150	1	1
152	5	1
154	3	
156	4	
158	3	
160	1	
162	1	
	18	15

Max. finger reach (span)	Male	Female
112		1
138		2
140		2
142		4
144	1	2
146	1	1
148	—	—
150	1	1
152	3	2
154	3	
156	2	
158	3	
160	2	
162	2	
	18	15

Excess of span over height	Male	Female
-10	1	2
-8	—	—
-6	2	2
-4	2	1
-2	3	4
0	3	4
2	5	1
4	1	—
6	1	—
8	—	—
10		1
	18	15

Sitting height	Male	Female
66	1	
68	—	1
70	2	3
72	1	2
74	1	6
76	2	2
78	4	—
80	3	—
82	3	—
84	1	1
	18	15

Sitting height per cent of total height	Male	Female
43	1	
44	—	
45	—	
46	1	
47	2	2
48	1	1
49	1	1
50	6	4
51	—	2
52	5	2
53	1	1
54	—	—
55	—	1
66	—	1
	18	15

Height-span index	Male	Female
93.		1
94.5	1	1
95.	—	—
95.5	—	1
96.	—	1
96.5	2	—
97.	—	—
97.5	1	1
98.	1	—
98.5	1	2
99.	1	1
99.5	1	2
100.	—	2
100.5	2	—
101.	2	1
101.5	2	—
102.	2	1
102.5	1	
103.		
103.5	1	
107.2		1
	18	15

CHEST MEASUREMENTS.

D. lateral	Male	Female
24		2
25	I	4
26	5	4
27	5	5
28	5	
29	I	
30	I	
	18	15

D. ant. post.	Male	Female
18	I	3
19	—	2
20	3	4
21	7	3
22	4	I
23	2	I
24	I	I
	18	15

Chest index	Male	Female
69		I
70	—	—
71	I	I
72	—	—
73	I	I
74	2	—
75	—	2
76	2	I
77	I	I
78	I	2
79	—	I
80	I	I
81	3	I
82	I	—
83	3	—
84	I	—
85	I	—
86	—	—
87	—	—
88	—	I
89	—	—
90	—	I
91	—	—
92	—	I
	18	15

LEFT HAND MEASUREMENTS.

Length	Male	Female
14.2		I
14.7		I
15.0		I
15.1	I	—
15.2	—	—
15.3	—	3
15.4	—	2
15.5	—	2
15.6	2	—
15.7	I	—
15.8	I	I
15.9	—	—
16.0	—	I
16.1	I	—
16.2	3	I
16.3	I	—
16.4	I	—
16.5	—	—
16.6	I	I
16.7	—	—
16.8	—	I
16.9	I	
17.0	I	
17.1	I	
17.2	I	
17.3	I	
17.4	—	
18.3	I	
	18	15

Width	Male	Female
6.9		3
7.2		5
7.3	—	—
7.4	I	2
7.5	2	—
7.6	I	2
7.7	2	—
7.8	3	2
7.9	—	—
8.0	—	—
8.1	I	I
8.2	I	—
8.3	I	
8.4	I	
8.5	—	
8.6	I	
8.7	I	
8.8	I	
8.9	I	
9.0	I	
	18	15

Hand index	Male	Female
44.5		I
45.0		2
45.5	I	—
46.0	I	2
46.5	I	3
47.0	3	I
47.5	I	—
48.0	2	2
48.5	—	I
49.0	—	I
49.5	—	—
50.0	I	I
50.5	3	I
51.0	I	
51.5	I	
52.0	I	
52.5	I	
53.0	—	
53.5	—	
54.0	I	
	18	15

HAND PRESSURE.

	Right hand	
Kilos	Males	Females
7		1
8		1
9		—
10		2
11	1	1
12	—	3
13	—	2
14	1	1
15	1	1
16	1	1
17	2	1
18	—	—
19	1	—
20	—	—
21	1	—
22	—	1
23	1	
24	2	
25	2	
26	1	
27	1	
28	1	
29	1	
33	1	
	18	15

	Left hand	
Kilos	Males	Females
6		1
7		1
8		2
9	1	3
10	—	1
11	—	1
12	1	2
13	1	2
14	2	1
15	1	1
16	—	
17	1	
18	—	
19	1	
20	1	
20	—	
22	1	
23	3	
24	—	
25	1	
26	1	
27	1	
28	1	
35	1	
38	1	
	18	15

HAND STATURE INDEX.

Kilos	Males	Females
9.4	1	
10.0	1	1
10.2	3	—
10.4	7	5
10.6	2	4
10.8	1	1
11.0	2	2
11.2	—	—
11.4	1	—
11.6	—	—
11.8	—	1
12.0	—	—
12.2	—	1
	18	15

FOOT MEASUREMENTS (LEFT).

	Length	
	Male	Female
18		1
19		1
20		8
21	2	5
22	8	
23	6	
24	2	
	18	15

	Width	
	Male	Female
8.0		1
8.1		—
8.2		3
8.3		4
8.4	1	3
8.5	—	—
8.6	1	—
8.7	—	2
8.8	1	1
8.9	2	—
9.0	—	—
9.1	—	—
9.2	2	—
9.3	—	—
9.4	1	—
9.5	1	—
9.6	1	—
9.7	2	1
9.8	—	
9.9	—	
10.0	2	
10.1	—	
10.2	1	
10.3	1	
10.4	1	
11.4	1	
	18	15

	Index	
	Male	Female
36	1	
37	—	—
38	1	1
39	3	3
40	5	3
41	—	4
42	1	2
43	4	1
44	1	1
45	1	—
46	—	
47	—	
48	1	
	18	15

FOOT AND LEG MEASUREMENTS.

Left leg circum. max.

	Male	Female
26.5		1
27.		1
27.5		—
28.		—
28.5	1	2
29.	3	—
29.5	—	1
30.	1	—
30.5	1	1
31.	1	4
31.5	—	—
32.	1	—
32.5	4	1
33.	—	1
33.5	—	2
34.	2	1
34.5	1	
35.	1	
35.5	1	
36.	—	
36.5	1	
	18	15

Stature-leg circum. index

	Male	Female
18	2	2
19	4	2
20	5	3
21	3	1
22	3	3
23	1	3
24		—
25		—
26		1
	18	15

Foot stature index

	Male	Female
13.2		1
13.4		—
13.6		—
13.8	1	3
14.0	3	4
14.2	2	2
14.4	3	—
14.6	1	1
14.8	1	1
15.0	6	1
15.2	—	1
15.4	1	—
16.0		1
	18	15

NOSE MEASUREMENTS.

Height to nasion?

	Male	Female
3.8		1
4.2		1
4.3	1	1
4.4	1	1
4.5	—	2
4.6	2	3
4.7	1	1
4.8	2	3
4.9	3	—
5.0	1	—
5.1	3	1
5.2	—	1
5.3	—	
5.4	1	
5.5	—	
5.6	—	
5.7	2	
5.8	1	
	18	15

Width max.

	Male	Female
3.3		1
3.4		1
3.5		—
3.6		2
3.7	1	4
3.8	1	1
3.9	2	1
4.0	3	1
4.1	2	2
4.2	—	1
4.3	1	—
4.4	3	—
4.5	2	—
4.6	2	1
4.9	1	
	18	15

Nasal index?

	Male	Female
68	1	1
72	1	1
74	—	—
76	2	1
78	1	2
80	3	1
82	1	2
84	1	2
86	2	—
88	3	1
90	—	2
92	—	—
94	1	1
96	—	1
98	—	
100	—	
102	1	
111	1	
	18	15

EAR MEASUREMENTS.

Height	Male	Female
5.4		2
5.5	1	3
5.6	—	1
5.7	—	—
5.8	—	—
5.9	5	3
6.0	1	2
6.1	1	—
6.2	2	1
6.3	1	—
6.4	3	2
6.5	2	
6.6	—	
6.7	—	
6.8	1	
6.9	—	
7.0	—	
7.1	1	
7.4	—	1
	18	15

Breadth	Male	Female
3.3		1
3.4	2	4
3.5	2	2
3.6	2	2
3.7	2	3
3.8	1	2
3.9	3	1
4.0	2	
4.1	3	
4.9	1	
	18	15

Index	Male	Female
45		1
55	1	1
56	1	1
57	2	—
58	—	1
59	3	1
60	3	—
61	2	2
62	1	2
63	3	3
64	—	1
65	—	—
66	—	1
67	1	1
83	1	
	18	15

FACE MEASUREMENTS.

Morphologic facial index?	Male	Female
77		1
78		—
79		1
80		—
81	1	—
82	—	—
83	1	2
84	3	—
85	—	1
86	1	—
87	2	3
88	2	3
89	1	1
90	1	1
91	2	—
92	3	—
93	—	1
94	—	1
95	1	—
	18	15

Physiognomic facial index	Male	Female
72	1	
74	1	1
75	—	2
76	1	1
77	5	2
78	—	—
79	1	2
80	2	1
81	3	—
82	1	—
83	2	2
84	—	1
85	1	1
86	—	2
	18	15

Mouth breadth	Male	Female
4.4	—	1
4.9	—	1
5.0	—	1
5.1	1	3
5.2	—	1
5.3	2	1
5.4	2	1
5.5	—	3
5.6	1	1
5.7	1	—
5.8	1	1
5.9	5	—
6.0	1	1
6.1	—	—
6.2	—	—
6.3	1	
6.4	2	
6.5	—	
6.6	1	
	18	15

FACE MEASUREMENTS.

Menton nasion?

	Male	Female
10.8	—	1
11.0	—	3
11.2	—	1
11.4	—	1
11.6	1	2
11.8	—	3
12.0	3	1
12.2	4	2
12.4	4	1
12.6	2	
12.8	—	
13.0	1	
13.2	3	
	18	15

Menton-crinion

	Male	Female
15.6		2
15.8		2
16.0		—
16.2		—
16.4		1
16.6	1	3
16.8	2	2
17.0	2	1
17.2	2	2
17.4	2	1
17.6	1	1
17.8	—	
18.0	1	
18.2	2	
18.4	1	
18.6	1	
18.8	1	
19.0	1	
19.2	1	
	18	15

Height of forehead?
(Nasion-crinion)

	Male	Female
3.4	1	—
3.6	—	1
3.8	—	—
4.0	—	—
4.2	—	1
4.4	1	—
4.6	1	2
4.8	2	2
5.0	2	2
5.2	—	3
5.4	3	2
5.6	2	—
5.8	3	1
6.0	2	1
6.2	—	
6.4	1	
	18	15

Diam. bizygom. max

	Male	Female
12.6		1
13.0		1
13.2		5
13.3		3
13.4		1
13.5	1	—
13.6	1	1
13.7	4	—
13.8	—	2
13.9	2	—
14.0	1	—
14.1	2	1
14.2	1	
14.3	1	
14.4	1	
14.5	1	
14.6	1	
14.7	—	
14.8	1	
14.9	—	
15.0	1	
	18	15

HEAD MEASUREMENTS.

Head: d. ant. post.

	Male	Female
16.8		3
17.0		2
17.2	3	1
17.4	—	5
17.6	1	2
17.8	2	1
18.0	3	0
18.2	3	1
18.4	—	—
18.6	5	
18.8	1	
	18	15

D. lateral max.

	Male	Female
13.2		1
13.4		—
13.6	1	1
13.8	—	3
14.0	1	2
14.2	4	6
14.4	4	1
14.6	2	
14.8	4	
15.0	1	1
15.2	—	
15.4	—	
15.6	1	
	18	15

Cephalic index

	Male	Female
73	1	
74	—	
75	1	
76	—	2
77	2	1
78	1	—
79	5	1
80	3	3
81	—	3
82	—	1
83	2	—
84	—	1
85	1	2
86	2	1
	18	15

Height line between auditory meati to bregma

	Male	Female
12.0	1	
12.1	1	
12.2	2	
12.3	2	
12.4	4	2
12.5	6	1
12.6	1	10
12.7	1	2
	18	15

Cephalic module

	Male	Female
14.4		4
14.6	2	4
14.8	1	5
15.0	6	2
15.2	7	
15.4	1	
15.6	1	
	18	15

Cephalic module vs. height

	Male	Female
93	1	
94	2	
95	3	
96	2	
97	3	
98	4	4
99	1	1
100	1	1
101	—	2
102	1	3
103		3
126		1
	18	15

HEAD MEASUREMENTS.

Head-height index

	Male	Female
64	1	
65	—	
66	1	
67	2	
68	—	
69	1	
70	—	1
71	7	1
72	2	1
73	1	4
74	1	4
75	2	3
76		1
	18	15

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EXPLANATION OF PLATES.

QUICHUA.

Types of forehead: retreating, 30♂; vertical, 32♂, 152♀; narrow, 13♀, 16♂; broad, 73♂; low, 129♀, 16♂.

Types of lips and mouth: procheilous, 128♀; orthocheilous, 135♂; upper lip, long, 122♀; upper lip, short, 121♀; everted, 102♀ (front); labio-nasal sulcus, marked, 122♀; medium, 126♀; slight, 129♀; absent, 137♂.

Head forms: brachycephalic, 125♀; dolichocephalic, 145♀; hypsicephalic, 122♀.

Types of nose: dorsum, sinuous, 119♂; straight, 136♂; convex, 144♂; concave, 130♀, 145♀; root depressed, 148♂; root prominent, 137♂; leptorrhine, 123♀; chamaerrhine, 126♀; Grecian, 137♂.

Types of ear: microtic, 144♂, 125♀; macrotic, 138♂, 128♀; adherent lobule, 67♀.

Types of face: leptoprosopic, 146♀; euryprosopic, 65♂, 37♀; oval, 123♀; angular, 125♀, 135♂; rectangular, 122♀; prognathic, 140♂; orthognathic, 135♂; prominent malars, 125♀; mongoloid, 142♀, side, 99♀, front.

No. 16♂ shows negroid type.

Many show enlarged thyroids as 15♂, 25♂, 38♀, 57♂, 59♀.

An osteoma is seen in 9♀.

MACHIGANGA.

Types of nose: dorsum, straight, 201♂, 232♀; convex, 202♂; concave and root depressed, 201♂, 213♀; leptorrhine, 206♂, 214♀; chamaerrhine, 208♂, 209♀.

Types of face: leptoprosopic, 204♂, 231♀; euryprosopic, 208♂, 209♀, 214♀; angular, 201♂; prognathic, 207♂, 210♀; orthognathic, 202♂, 213♀; prominent malars, 208♂.

Types of lips and mouth: procheilous, 207♂; orthocheilous, 202♂; upper lip long, 203♂; upper lip short, 209♀; labio-nasal sulcus, marked, 204♂; medium, 210♀; slight, 229♂.

Variations in amount of facial hair: absent, 202♂; slight, 201♂.

Head forms: dolichocephalic, 204♂, 212♀; brachycephalic, 224♂, 211♀; hypsicephalic, 210♀; chamaecephalic, 204♂, 214♀.

Complete data regarding individuals may be found in the general tables of measurements by referring to the serial number given under each photograph.

15

13

9

QUICHUA INDIANS.

16

25

30

QUICHUA INDIANS.

38

37

32

QUICHUA INDIANS.

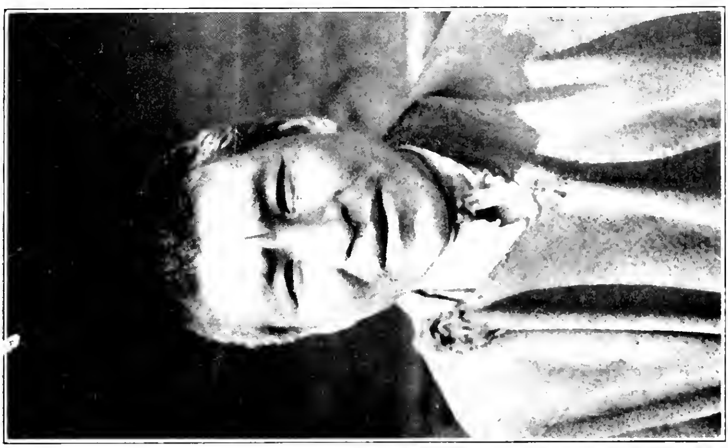
65

59

57

QUICHUA INDIANS.

67



73

98

QUICHUA INDIANS.

121

110

102

QUICHUA INDIANS.

123

122

122

QUICHUA INDIANS.

125

125

126

QUICHUA INDIANS.

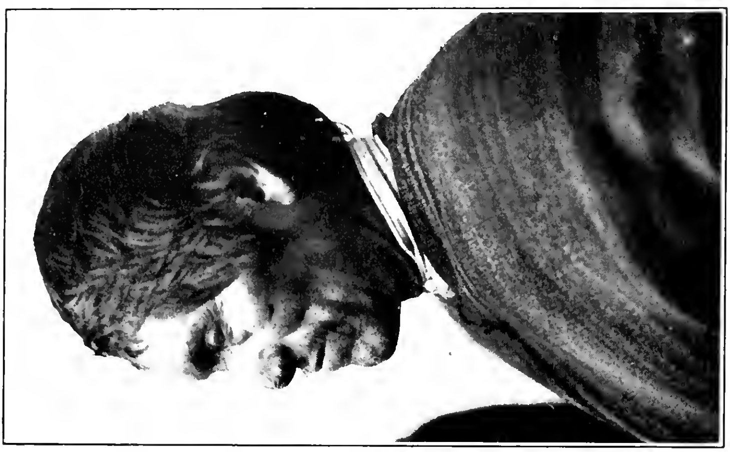
130

129

128

QUICHUA INDIANS.


135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QUICHUA INDIANS.

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QUICHUA INDIANS.

142

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QUICHUA INDIANS.

144

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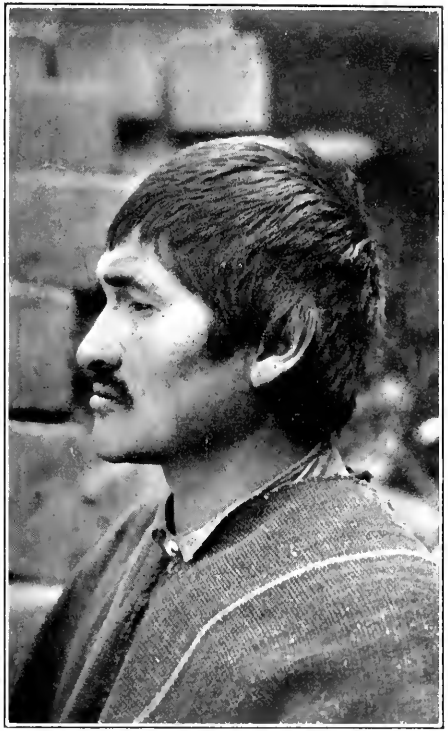
146

QUICHUA INDIANS.



148

152

QUICHUA INDIANS.

201

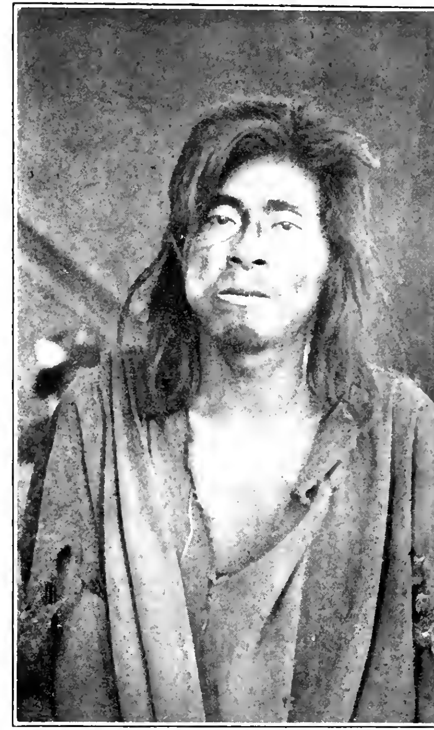
202

203

MACHIGANGA INDIANS.

204

204



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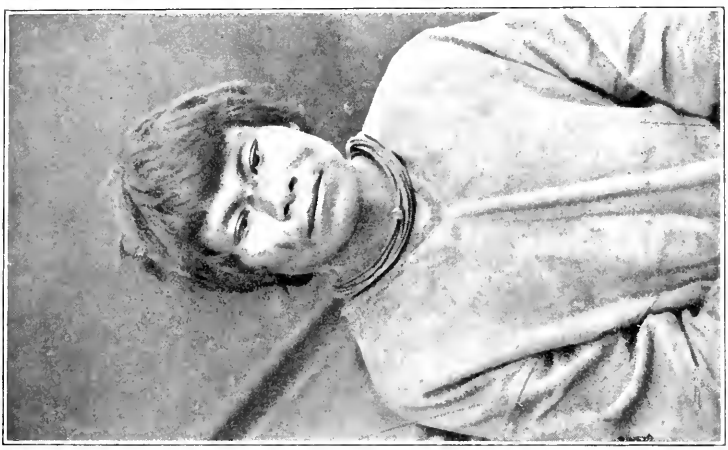
MACHIGANGA INDIANS.

207



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MACHIGANGA INDIANS.

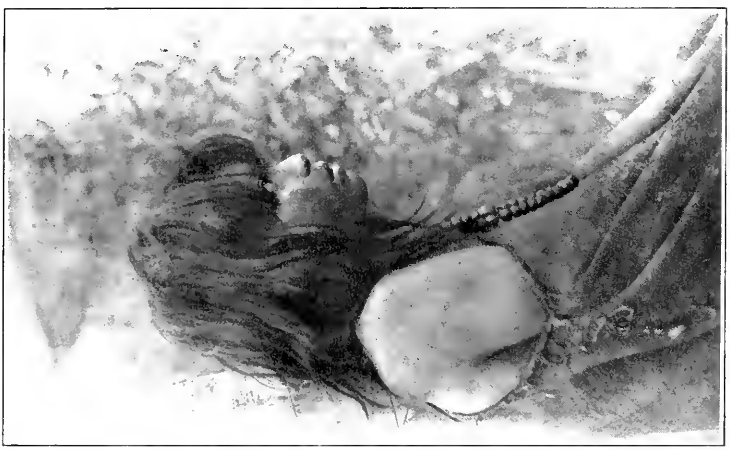
211

210

210

MACHIGANGA INDIANS.

212



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213

MACHIGANGA INDIANS.

220

224

214

MACHIGANGA INDIANS.

231

232

MACHIGANGA INDIANS.

INSPECTION RECORDS OF THE QUICHUA

No.	Sex	Skin Color	Hair Color	Hair Character	Hair Gray	Hair Lost	Moustache and beard Color	Moustache and beard Character	Eyes Iris	Eyes Conjunctiva	Forehead	Supraorbital ridges	Eye slits	Malars	Nasion depression	Nose	Nasal septum	Lips	Alveolar prognathism	Chin	Angle of lower jaw	Body and limbs	Number of children Shape of breast	Present state of health
1	M	Medium brown	Black	Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	+ Medium	Horizontal	+ Medium	Shallow	Concave	Sl. i. up*	+ Medium	Medium	Medium round	Medium			Normal
2	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	– Medium	+ Medium	Horizontal	+ Medium	Medium	Convex	Horizontal	Medium	Medium	Medium	Medium			Normal
3	M	Medium brown	Black	Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	Medium	I. C. L.†	+ Medium	High	Very convex	Sl. i. d.‡	Medium	Medium	Medium round	Medium			Normal
4	M	Dark brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	– Medium	I. C. L.	+ Medium	Medium	Concave	Sl. i. d.	Medium	Medium	Medium round	+ Medium			Normal
5	M	Medium brown	Black	Straight	None	None	Black	Sparse	Dark brown	White	– Medium	Medium	I. C. L.	+ Medium	Medium	Straight	Horizontal	Medium	Medium	Medium round	+ Medium			Normal
	M	Medium brown	Black	Straight	Many	Few	Black	Straight	Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	– Medium	Concave	Sl. i. d.	Medium	Medium	Round	– Medium			Normal
	M	Light brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	Medium	– Medium	Horizontal	+ Medium	Medium	Straight	Horizontal	Medium	Medium	Round	Medium			Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	– Medium	I. C. L.	Pronounced	Medium	Concave	Horizontal	Medium	Medium	– Medium square	Medium		Flat breast	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	White	Medium	– Medium	I. C. L.	+ Medium	Medium	Concave	Sl. i. d.	Medium	Medium	Medium round	– Medium	Goitre, both lateral lobes enlarged.*	4 children	Normal
	F	Light brown	Black	Straight	Few	Few			Dark brown	Yellowish	Medium	+ Medium	Horizontal	+ Medium	Medium	Concave	Horizontal	Medium	Medium	Medium	Medium		1 child	Normal
	M	Light brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	Medium round	Medium			Normal
	M	Medium brown	Black	Straight	None	None			Dark brown	White	Medium	Medium	I. C. L.	+ Medium	Medium	Slightly concave	Sl. i. up	Medium	Medium	+ Medium round	+ Medium		Conical breast	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	Horizontal	Pronounced	Medium	Straight	Sl. i. up	+ Medium	Medium	Medium round	+ Medium	Goitre, pockmarked, freckles	Conical breast	Normal
	F	Light brown	Black	Slightly wavy	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Straight	Sl. i. up	Medium	Medium	Medium	– Medium	Pockmarked	4 children	Normal
	M	Medium brown	Black	Straight	None	None	Black	Sparse and straight	Dark brown	Yellowish	Medium	– Medium	I. C. L.	+ Medium	Medium	Straight	Sl. i. d.	Medium	+ Medium	Medium	Medium	Goitre, middle and right lobes		Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	– Medium	Horizontal	+ Medium	Shallow	Straight	Sl. i. up	Medium	Medium	Medium	Medium	Goitre, left lobe enlarged slightly †		Normal
	M	Light brown	Black	Straight	None	None	Brown	Sparse	Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Shallow	Convex	Horizontal	Medium	Medium	Medium	Medium	Goitre, left and right enlarged equally ‡		Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	– Medium	Horizontal	Medium	Medium	Concave	Horizontal	+ Medium	Medium	Medium	Medium	Pockmarked		Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Sloping and high	– Medium	Horizontal	+ Medium	Shallow	Convex	Sl. i. up	Medium	Medium	Medium	Medium	Scar left angle jaw [illegible] old tubercular glands (?)		Normal
	M	Light brown	Black	Straight	None	None	Black and brown	Wavy	Medium brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Straight	Sl. i. up	Medium	+ Medium	Medium	Medium	Pockmarked		Normal
	M	Medium brown	Black	Straight	None	None	Black and brown	Wavy	Medium brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Convex	Horizontal	+ Medium	Medium	Medium	Medium			Normal
	M	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Slightly convex	Sl. i. up	+ Medium	+ Medium	– Medium	+ Medium		2 boys, 1 girl	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Straight	Horizontal	+ Medium	Medium	+ Medium	+ Medium		1 boy	Normal
	F	Medium brown	Black	Straight	None	None	Black	Sparse and straight	Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Convex	Horizontal	Medium	+ Medium	Medium	Medium	Goitre		Normal
	M	Light brown	Black	Straight	None	None	Black	Sparse and straight	Dark brown	Yellowish	Medium	+ Medium	I. C. L.	+ Medium	Medium	Concave	Sl. i. up	+ Medium	Medium	+ Medium	+ Medium	Goitre		Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	+ Medium	I. C. L.	+ Medium	Medium	Convex	Sl. i. d.	Medium	+ Medium	+ Medium square	+ Medium	Pockmarked		Normal
	M	Medium brown	Black	Straight	Few	Few	Black	Sparse	Medium brown	Yellowish	Medium	+ Medium	Horizontal	Pronounced	Medium	Straight	Horizontal	Medium	+ Medium	Medium	+ Medium	Pockmarked		Normal
	M	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	– Medium	Medium	I. C. L.	Pronounced	Medium	Concave	Sl. i. up	Medium	+ Medium	Medium	Medium		1 girl	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	– Medium	Slightly convex	Sl. i. up	Medium	Medium	Medium	Medium	Freckles	1 girl	Normal
	M	Medium brown	Black	Straight	Few	None	Black	Sparse	Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Convex	Horizontal	Medium	Medium	+ Medium	+ Medium	Goitre, middle and right lobes		Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Medium	Convex	Sl. i. up	Medium	Medium	– Medium	+ Medium	Pockmarked, freckles	4 girls	Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	– Medium	Medium	I. C. L.	+ Medium	– Medium	Convex	Sl. i. up	Medium	Medium	Medium	Medium	Lost first [illegible] third finger l. ft. slight goitre		Normal
	M	Medium brown	Black	Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Convex	Sl. i. d.	+ Medium	Medium	Medium	Medium	Slight goitre		Normal
	M	Light brown	Black	Straight	None	None	Black	Sparse and straight	Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	High	Convex	Sl. i. d.	Medium	Medium	Medium	– Medium	Pockmarked, freckles		Normal
	M	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	– Medium	I. C. L.	+ Medium	– Medium	Straight	Horizontal	Medium	Medium	+ Medium	+ Medium	Pockmarked		Intoxicated
	M	Medium brown	Black	Straight	Few	Few	Black few gray	Straight	Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Straight	Horizontal	+ Medium	Medium	Medium	+ Medium	Freckles		Intoxicated
	M	Light brown	Black	Straight & fine	None	None			Brown	White	Medium	Medium	Horizontal	Pronounced	Medium	Slightly convex	Sl. i. up	Medium	Medium	Medium	+ Medium	Pockmarked, freckles	1 boy, 1 girl	Normal
	F	Dark brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	Pronounced	Medium	Concave	Sl. i. up	Medium	Medium	Medium	+ Medium	Goitre	1 boy	Normal
	M	Medium brown	Black	Straight	Few	Few	None		Dark brown	Yellowish	Medium	– Medium	Horizontal	Medium	Medium	Convex	Horizontal	+ Medium	Medium	Medium	Medium	Goitre central lobe, left lobe		Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	+ Medium	I. C. L.	Medium	Medium	Concave	Sl. i. up	+ Medium	Medium	Medium	Medium	Pockmarked		Normal
	F	Dark brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Shallow	Straight	Horizontal	Medium	Medium	Medium	Medium	Goitre	1 boy, 2 girls	Normal
	M	Dark brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	Medium	+ Medium	Horizontal	Pronounced	Medium	Straight	Sl. i. d.	+ Medium	Medium	Medium	Medium	Goitre, middle and right lobes		Normal
	M	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Convex	Sl. i. d.	+ Medium	Medium	Medium	Medium			Normal
	F	Medium brown	Black	Straight	Few	Few			Dark brown	Yellowish	Medium	+ Medium	Horizontal	+ Medium	Medium	Concave	Inc. up	Medium	Medium	Medium	Medium	Goitre	3 boys, 3 girls	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	Horizontal	+ Medium	Medium	Straight	Inc. up	+ Medium	Medium	Medium	Medium		1 boy, 1 girl	Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Medium	Slightly convex	Sl. i. up	+ Medium	Medium	Medium	Medium			Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	+ Medium	Medium	Horizontal	Pronounced	Medium	Straight	Sl. i. up	Medium	Medium	Medium	+ Medium	Freckles, slightly enlarged thyroid	1 boy, 2 girls	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	White	Medium	Medium	I. C. L.	Medium	Medium	Straight	Sl. i. up	Medium	Medium	Medium	+ Medium		Conical breast	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Shallow	Concave	Sl. i. up	+ Medium	Medium	Medium	Medium	Goitre	1 boy	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	Pronounced	Medium	Straight	Sl. i. up	+ Medium	Medium	Medium	+ Medium	Pockmarked	1 boy, 1 girl	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	Medium	Convex	Sl. i. up	Medium	Medium	Medium	+ Medium	Slight goitre, right, freckles	1 boy, 1 girl	Normal
	M	Medium brown	Black	Straight	None	None	Black	Wavy	Medium brown	Yellowish	Medium	+ Medium	I. C. L.	+ Medium	Medium	Straight	Sl. i. d.	Medium	Medium	Medium pointed	+ Medium			Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	Medium	+ Medium	Pockmarked	1 boy	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Straight	Inc. up	Medium	Medium	Medium	+ Medium		2 boys, 3 girls	Normal
	F	Light brown	Black	Straight	None	None	None		Dark brown	Yellowish	Vertical and high	Medium	I. C. L.	+ Medium	Medium	Straight	Sl. i. up	Medium	Medium	Medium square	+ Medium			Normal
	F	Medium brown	Black	Straight	Few	None			Dark brown	Yellowish	Medium	Medium	Horizontal	Pronounced	High	Very convex	Horizontal	Medium	Medium	Medium	Medium			Normal
	F	Medium brown	Black	Straight	None	None	None		Dark brown	Inflamed	Medium	Medium	Horizontal	+ Medium	Medium	Straight	Horizontal	Medium	Medium	– Medium	Medium	Goitre, pockmarked		Conjunctivitis
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	Horizontal	Pronounced	Medium	Straight	Sl. i. up	+ Medium	Medium	Medium	Medium	Goitre, pockmarked		Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	I. C. L.	Pronounced	Shallow & wide	Slightly convex	Sl. i. up	+ Medium	Medium	Medium	Medium	Goitre	1 boy	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Wide	Straight	Sl. i. up	+ Medium	Medium	Medium	Medium		1 boy	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Shallow	Convex	Inc. up	+ Medium	Medium	Medium	+ Medium	Pockmarked	1 boy	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	White	Medium	Medium	Horizontal	Pronounced	Medium	Straight	Horizontal	Medium	Medium	Medium	Medium	Freckled	Conical breast	Normal
	M	Medium brown	Black	Straight	None	Few	Black many gray	Straight	Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Straight	Sl. i. up	Medium	Medium	Medium	Medium			Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	White	Medium	Medium	I. C. L.	Pronounced	Medium	Convex	Sl. i. d.	+ Medium	Medium	Medium	Medium	Mongolian fold		Normal
	M	Light brown	Black	Straight	None	None	Black	Straight	Medium brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Straight	Sl. i. d.	Medium	Medium	Medium	Medium	Pockmarked, freckles		Normal
	M	Medium brown	Black	Straight	None	Few	Black	Straight and sparse	Dark brown	Yellowish	Medium	+ Medium	Horizontal	Pronounced	Shallow	Convex	Sl. i. d.	Medium	+ Medium	Medium	+ Medium	Pockmarked		Normal
	M	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	Horizontal	Pronounced	Medium	Concave	Sl. i. up	Medium	Medium	Medium	Medium			Piles
	F	Light brown	Black	Straight	None	None	Black		Dark brown	Yellowish	Medium	+ Medium	I. C. L.	Pronounced	Medium	Concave	Horizontal	Medium	Medium	Medium	Medium	Pockmarked	1 boys, 1 girls	Normal
	M	Medium brown	Black	Straight	None	None	Few brown hairs	Few	Dark brown	Yellowish	+ Medium	Medium	Horizontal	Pronounced	Medium	Convex	Sl. i. d.	Medium	Medium	+ Medium	+ Medium			Normal
	M	Light brown	Black	Straight	None	Few		Straight	Dark brown	Yellowish	Medium	Medium	Horizontal	Pronounced	Medium	Convex	Sl. i. d.	Medium	Medium	Medium	Medium			Normal
	M	Medium brown	Black	Straight	Few	Few	Few gray	Straight	Dark brown	Yellowish	Medium	Medium	Horizontal	Pronounced	Medium	Concave	Sl. i. up	Medium	Medium	Medium	Medium	Pockmarked		Normal
	M	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	Horizontal	Pronounced	Wide	Concave	Sl. i. up	+ Medium	Medium	– Medium	– Medium	Pockmarked	2 boys, 2 girls	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	– Medium	I. C. L.	Pronounced	Medium	Concave	Sl. i. d.	Medium	Medium	Medium	+ Medium			Normal
	M	Light brown	Black	Straight	None	None	Few brown hairs	Straight	Dark brown	White	Medium	Medium	Horizontal	+ Medium	Medium	Straight	Sl. i. up	Medium	Medium	+ Medium	Medium	Pockmarked		Normal
	M	Medium brown	Black	Straight	None	None	Black	Sparse	Black	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	– Medium	Medium	Pockmarked		Normal
	M	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	Pronounced	Medium	Convex	Sl. i. d.	Medium	Medium	+ Medium	+ Medium		1 boy, 2 girls	Normal
	M	Medium brown	Black	Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	+ Medium	Horizontal	+ Medium	Medium	Convex	Sl. i. up	– Medium	Medium	Medium	+ Medium			Normal
	M	Light brown	Black	Straight	None	None	None		Dark brown	White	Medium	+ Medium	I. C. L.	+ Medium	Medium	Convex	Sl. i. d.	+ Medium	Medium	Medium	+ Medium			Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	+ Medium	I. C. L.	+ Medium	Medium	Convex	Med. i. d.	Medium	Medium	Medium	+ Medium	Pockmarked		Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	I. C. L.	+ Medium	Medium	Slightly convex	Sl. i. d.	+ Medium	+ Medium	Medium	Medium	Pockmarked	1 boy	Normal
	M	Medium brown	Black	Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	+ Medium	I. C. L.	Pronounced	Shallow	Convex	Med. i. d.	Medium	+ Medium	Medium	Medium	Varicose veins, pockmarked	[illegible]	Normal
	M	Medium brown	Black	Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	+ Medium	I. C. L.	Pronounced	Medium	Concave	Sl. i. up	Medium	Medium	+ Medium	+ Medium		[illegible]	Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	High	Concave	Sl. i. d.	Medium	Medium	Medium	+ Medium	Mongolian fold		Normal
	M	Light brown	Black	Straight	None	Few	Black	Straight	Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	Medium	Convex	Sl. i. d.	+ Medium	Medium	Medium	Medium			Normal
	M	Medium brown	Black	Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	+ Medium	I. C. L.	+ Medium	Wide	Slightly convex	Sl. i. up	Medium	Medium	Medium	Medium			Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	Medium	+ Medium			Normal
	M	Light brown	Black	Straight	None	None	None		Medium brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Slightly concave	Sl. i. d.	Medium	Medium	Medium	Medium			Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	High	Convex	Sl. i. d.	Medium	+ Medium	Medium	+ Medium		Conical breast	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Concave	Sl. i. d.	Medium	Medium	Medium	+ Medium	[illegible]	2 boys, 1 girl	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Slightly convex	Horizontal	Medium	Medium	Medium	+ Medium		2 boys, 1 girl	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	I. C. L.	+ Medium	Shallow	Concave	Sl. i. up	+ Medium	Medium	Medium	+ Medium		1 boy, 1 girl	Normal
	M	Light brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	Medium	+ Medium	I. C. L.	+ Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	Medium	+ Medium			Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Slightly concave	Sl. i. d.	Medium	Medium	Medium	– Medium	Pockmarked	Conical breast	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Medium	Convex	Sl. i. d.	Medium	Medium	Medium	+ Medium		No children (?)	Normal
	M	Light brown	Black	Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	+ Medium	Horizontal	Pronounced	Medium	Convex	Sl. i. up	Medium	Medium	Medium	+ Medium			Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	High	Concave	Sl. i. d.	+ Medium	Medium	Medium	Medium			Normal
	F	Light brown	Black	Straight	None	None			Medium brown	White	Medium	Medium	Horizontal	+ Medium	Medium	Straight	Sl. i. up	Medium	Medium	+ Medium	+ Medium		2 boys, 4 girls	Normal
	F	Light brown	Black	Straight	None	None			Medium brown	White	Medium	– Medium	Horizontal	+ Medium	Medium	Concave	Sl. i. up	Medium	Medium	Medium	+ Medium		1 boy	Normal
	F	Light brown	Black	Straight	None	None			Medium brown	Yellowish	Medium	– Medium	I. C. L.	Medium	Shallow	Concave	Sl. i. up	Medium	+ Medium	Medium	Medium		No children	Over fat
	F	Medium brown	Black	Straight	None	None			Dark brown	White	Medium	Medium	I. C. L.	+ Medium	Wide	Slightly convex	Sl. i. up	Medium	Medium	Medium	+ Medium		No children	Normal
	F	Light brown	Black	Straight	None	None			Medium brown	White	Medium	Medium	Horizontal	Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	Medium	+ Medium		2 boys, 1 girls	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	White	Medium	Medium	I. C. L.	Medium	Wide	Straight	Sl. i. up	+ Medium	Medium	Medium	+ Medium	Mongolian fold	Conical breast	Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Convex	Sl. i. d.	Medium	Medium	Medium	+ Medium			Normal
	M	Medium brown	Black	Straight	Few	None	Black & 1 white	Straight	Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Concave	Sl. i. d.	Medium	Medium	+ Medium	Medium			Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	– Medium	Medium	I. C. L.	+ Medium	Medium	Concave	Sl. i. up	Medium	Medium	Medium	Medium			Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	Horizontal	+ Medium	Medium	Slightly concave	Sl. i. up	Medium	Medium	Medium	+ Medium		1 girl	Normal
	M	Light brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Wide	Slightly convex	Sl. i. up	Medium	Medium	Medium	+ Medium			Normal
	M	Light brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Wide	Straight	Sl. i. up	Medium	Medium	Medium	+ Medium			Normal
	M	Light brown	Black	Straight	None	None	Black	Straight and sparse	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Wide	Slightly convex	Sl. i. d.	+ Medium	Medium	Medium	+ Medium	Pockmarked		Normal
	M	Light brown	Black	Straight	None	None	Some brown	Sparse	Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Deep	Concave	Sl. i. up	Medium	Medium	Medium square	Medium			Normal
	M	Light brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	+ Medium	+ Medium			Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	+ Medium	I. C. L.	+ Medium	Medium	Medium convex	Sl. i. d.	+ Medium	Medium	Medium	+ Medium	Pockmarked		Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Concave	Sl. i. up	+ Medium	+ Medium	Medium	+ Medium	Pockmarked		Normal
	M	Medium brown	Black	Straight	Few	None	None		Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	Narrow	Convex	Sl. i. d.	Medium	Medium	Medium square	+ Medium	Pockmarked		Normal
	M	Light brown	Black	Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Convex	Sl. i. up	Medium	Medium	Medium	+ Medium			Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Wide	Slightly concave	Sl. i. d.	Medium	Medium	Medium	+ Medium	Mongolian fold	Conical breast	Normal
	M	Medium brown	Black	Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	+ Medium	Horizontal	Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	Medium	Medium			Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	Medium	Slightly convex	Sl. i. d.	Medium	Medium	Medium	Medium		1 boy, 4 girls	Normal
	M	Medium brown	Black	Straight	Few	Few	Black few gray	Straight	Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	High	Slightly concave	Sl. i. d.	Medium	Medium	Medium square	Medium			Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Shallow	Slightly concave	Sl. i. up	Medium	Medium	Medium	+ Medium		2 boys, 2 girls	Normal
	F	Medium brown	Black	Straight	Few	None			Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	Medium	Slightly concave	Sl. i. d.	+ Medium	Medium	Medium	+ Medium	Goitre	1 boy, 1 girl	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	Horizontal	– Medium	Shallow	Slightly convex	Sl. i. d.	Medium	Medium	Medium	+ Medium			Normal
	F	Medium brown	Black	Straight	Few	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Medium convex	Sl. i. up	Medium	Medium	Medium	Medium		3 boys	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	– Medium	+ Medium	Horizontal	+ Medium	Medium	Slightly convex	Sl. i. up	+ Medium	Medium	Medium	Medium		4 boys, 2 girls	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Shallow	Slightly convex	Sl. i. up	+ Medium	Medium	Medium	Medium		1 boy, 4 girls	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	Deep	Convex	Med. i. up	+ Medium	Medium	Medium	+ Medium	Cretin, deaf and dumb	Conical breast	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Prominent	+ Medium	Horizontal	+ Medium	Medium	Convex	Sl. i. up	Medium	Medium	Medium	Medium		3 girls	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Shallow	Straight	Sl. i. up	Medium	Medium	Medium	Medium		1 boy, 3 girls	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	I. C. L.	+ Medium	Medium	Very convex	Sl. i. up	Medium	Medium	Medium	+ Medium		Conical breast	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Wide	Concave	Sl. i. up	Medium	Medium	Medium	+ Medium		2 girls	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	+ Medium pointed	Medium	Cut on hand	1 boy, 1 girl	Normal
	M	Medium brown	Black	Straight	Few	Few	Gray	Straight	Dark brown	Yellowish	Medium	+ Medium	Horizontal	+ Medium	Medium	Straight	Sl. i. up	Medium	Medium	Square	+ Medium			Normal
	M	Light brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	High	Slightly convex	Sl. i. d.	Medium	Medium	Medium	+ Medium			Normal
	M	Medium brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	High	Convex	Sl. i. up	Medium	Medium	Medium	+ Medium			Normal
	M	Dark brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	Medium	+ Medium	Horizontal	+ Medium	Medium	Straight	Sl. i. up	Medium	Medium	Medium	+ Medium			Normal
	M	Medium brown	Black	Straight	Few	None	Black, some gray	Straight	Dark brown	Yellowish	Medium	+ Medium	Horizontal	+ Medium	Medium	Straight	Sl. i. up	Medium	Medium	Medium	+ Medium	One finger deformed		Normal
	M	Light brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	Medium	I. C. L.	Medium	High	Slightly concave	Sl. i. up	Medium	Medium	Medium	Medium			Normal
	M	Medium brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	– Medium	+ Medium	Horizontal	+ Medium	Medium	Slightly concave	Sl. i. up	Medium	Medium	Square	+ Medium			Normal
	M	Medium brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	Medium	+ Medium	Horizontal	Medium	Medium	Slightly convex	Sl. i. d.	Medium	Medium	Medium	Medium			Normal
	M	Medium brown	Black	Straight	None	None	None		Dark brown	Yellowish	Medium	+ Medium	I. C. L.	Pronounced	Deep	Slightly convex	Sl. i. up	+ Medium	Medium	Medium	+ Medium			Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	Medium	Medium	Straight	Med. i. up	Medium	Medium	Medium	+ Medium		1 boy, 2 girls	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Shallow	Slightly convex	Sl. i. up	Medium	Medium	+ Medium pointed	Medium		Conical breast	Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	Medium	Medium		1 boy, 2 girls	Normal
	M	Medium brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Slightly convex	Sl. i. up	+ Medium	Medium	Medium	Medium			Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Concave	Med. i. up	Medium	Medium	Medium	Medium		2 boys, 1 girl	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	+ Medium	Horizontal	Medium	Wide	Concave	Sl. i. d.	Medium	Medium	Medium	+ Medium		1 boy, 1 girl	Normal
	M	Medium brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Slightly convex	Sl. i. up	+ Medium	Medium	Medium	+ Medium			Normal
	M	Medium brown	Black	Straight	None	None	Black	Straight	Dark brown	Yellowish	Medium	+ Medium	Horizontal	+ Medium	Medium	Slightly convex	Sl. i. d.	+ Medium	Medium	Medium	+ Medium			Normal
	M	Light brown	Black	Straight	None	None	Some brown	Straight	Medium brown	Yellowish	Medium	Medium	Horizontal	Medium	Medium	Straight	Sl. i. up	Medium	Medium	Medium	+ Medium			Normal
	F	Light brown	Black	Straight	None	None			Dark brown	Yellowish	Medium	Medium	Horizontal	+ Medium	Medium	Slightly concave	Horizontal	Medium	Medium	Medium	Medium		2 girls	Normal
	F	Medium brown	Black	Straight	None	None			Dark brown	Yellowish	+ Medium	+ Medium	I. C. L.	+ Medium	Wide	Slightly concave	Sl. i. up	+ Medium	Medium	Medium	+ Medium		3 boys	Normal
	F	Light brown	Black	Straight	None	None			Medium brown	Yellowish	Medium	Medium	Horizontal	Medium	Medium	Slightly convex	Sl. i. up	Medium	Medium	Medium	+ Medium		No children	Normal
	M	Light brown	Black	Straight	Few	Few	Black	Straight	Dark brown	Yellowish	Medium	Medium	I. C. L.	+ Medium	Medium	Slightly convex	Sl. i. d.	Medium	Medium	Medium	Medium			Normal

* Sl. i. up Slightly inclined up
† I. C. L. Inner Canthus Lower
‡ Sl. i. d. Slightly inclined down

* Osteoma on right side of lower jaw
† Central lobe much, right extremely. No exophthalmos
‡ Right a little more central than left and downward

Number	Sex	Approximate age	Height	Sitting height	Sitting height per cent of total height	Head diam ant post max	Diam lateral max	Cephalic index	Height line auricular to bregma	Cephalic module	Cephalic module and height	Face menton nasion	Menton crinion	Height of forehead (nasion crinion)	Diam bizygom max	Facial Index Morphologic	Facial Index Physiognomic	Nose height to nasion	Nose width max	Nasal index	Mouth breadth	Chest Diam lateral	Chest Diam ant post	Chest Index	Left Hand Length	Left Hand Width	Left Hand Index	Left Foot Length	Left Foot Width	Left Foot Index	Left leg circum max	Temperature (sublingual)	Pulse	Respiration	Left Ear Height	Left Ear Breadth	Left Ear Index	Hand Pressure Right	Hand Pressure Left
1	M					19 3						13 4																											
2	M					15 4	15 5				95 5	13 4																											
3	M	45				15 5	14 9			15 13	95 3	14 0																											
4	M											15 6																											
5	M					19 1						12 8																											
6	M	49					11 9					12 1																											
7	M	30				15 4						13 4																											
8	F	21			49 22	19 0																																	
9	F						14 0					13 4																											
10	F	40	140 5		54 ??	15 2																																	
11	M	44	152 4	86 9		18 6	15 6				105 0	12 6																											
12	F	21			54 68	17 8	14 4	80 90	12 6	14 93		11 4																											
13	F	35	144			17 6	14 4	81 82	11 1	15 10		12 0																											
14	F	22	137 5	75 3	54 76	15 9	14 5	81 00				11 4																											
15	M	30	162 5	87 6	54 01	20 6	15 4	74 76	14 1	16 30	112 8	11 8																											
16	M	26	152 0	80 6	55 16	15 6	14 0	80 11	15 0																														
17	M	26	200 4	91 5			13 9		13 5			12 6																											
18	M	22			54 60		15 0				93 1	12 8																											
19	M	24	150 6		50 33																																		
20	M	30					15 1																																
21	M	42	147 6									13 6																											
22	F	23	142 4				14 0																																
23	F	21	141 2								107 4	11 8																											
24	M	35	151 6				15 6			16 97																													
25	M	40	156 4	81 4	53 09							11 8																											
26	M	29			54 94		15 0																																
27	M	46	150 1	93 4	51 65																																		
28	F																																						
29	F																																						
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37	F																																						
38	F																																						
39	M																																						
40	M	19	148 2	77 4	52 23	18 4	14 9	81 0		15 47	104 4	14 4	18 9																										
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43	M																																						
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122	F																																						
123	F																																						
124	F																																						
125	F																																						
126	F	32	135 3	74 3	54 92	18 0	15 4	85 56		15 53																													
127	F																																						
128	F																																						
129	F	19	152 1	80 0	52 60	17 0	14 4	84 ??																															
130	F		150 2	84 0	55 93	18 7	14 0	74 87	11 8	15 50	103 4	12 6	15 8																										
131	M		149 8	84 4	56 34	17 8																																	
132	M	39	182 5	93 0	50 96	19 3																																	
133	M	32	160 0	89 6	55 68	19 2																																	
134	M	26																																					
135	M																																						
136	M	43																																					
137	M																																						
138	M	35																																					
139	M	34																																					
140	M	24																																					
141	F	35	144 8	75 1	51 86	17 7	14 3		12 7		102 9																												
142	F	22	164 6	84 2	51 15	19 5	15 4	78 97										5 4	1 1	62 26	5 3	27 9	20 6	73 84	15 1	7 8	51 7	20 5	8 4	41 0	34 0		76	16	6 2	3 6	58 1	22	16
143	F				70 20	17 9						14 1			14 1				1 8	63 11			22 0		16 4		46 3	23 0	9 0	39 1	41 3		77	18	5 8			3	3
144	M	30	125 2	87 7	70 00	18 9								4 9		110		5 5	3 7	67 27		26 9			15 4		51 05	20 5	8 6	42 0	36 4		84		5 5			11	9
145	F	22	125 5	78 1	62 23	18 8			11 9		124 1			4 1	13 2	108 3	70 6	5 6	3 9	69 64		27 0	21 0	75 27	16 1	8 5	52 8	22 4	9 0	40 2	32 0			16					
146	F	27	125 1	81 6	65 ??	18 0	14 4					14 8		4 1		97	76 5	5 6	3 7	66 07	5 0	28 0	18 5	66 07		7 9	47 0		9 1	41 9	32 2								
147	M	31	171 5	91 5	53 35	19 7						14 8				109 6	74 6	6 4	4 0	62 50	5 4	25 3	21 1	81 4	16 6				8 6				81		6 6			3	4
148	M	35	152 1	90 7	57 73	19 4	15 3	77 86	11 9	16 30	95 0	15 1		2 9	13 6			5 8	4 1	74 14		32 2	23 7	72 4						35 25	36 8		81	16	6 1	3 9	60 9	13	14
149	M	30	160 8	83 5	51 93	19 4	15 6		14	16 31		13 0		4 8	14 9			5 6				31 2	23 4			8 6			9 3	41 3	34 1		85	14	6 2	3 2	56 5	22	22
150	F	19	125 0	82 7	66 16	17 6	14 9	76 80	11 8	16 01	99 7	13 3		4 7		97 1		5 4	1 7	68 34		30	21 3	69 71	17 6	8 6	49 0			41 3	34 3		78	14	6 4	4 1		44	13
151	F	21	150 7	85 6	56 80	17 6	14 2	91 68	13 1	14 07	99 1		16 4	4 2	12 8	95 3	78 45	4 8	3 9	81 45	5 4	20 9	21 6		15 6	8 2	51 4			32 6	31 4						56 46		6
152	F	30	152 6	83 4	54 01	17 9	13 4	76 03	13 0	15 41	101 1		17 0	4 9	13 7	95 6		5 2	3 3	65 38	5 1	28 0	21 7		15 9		45 4	21 8	9 0	41 7	42 6		81	14	4 9	3 8	64 4	21	12
153	M		152 1	83 2	54 64	17 9	14 1		13 9	15 10	100 6	13 0	17 9	4 9	13 9			4 8	4 2	85 42	5 6	27 9	21 6					22 1		44 3	36 5			14		3 5	57 4	13	15
Averages Males		31	158 4	83 0	52 54	19 0	15 0	79 46	11 4	15 76	100 0	13 5	18 45	4 8	14 1	96 35	76 9	5 7	4 0	69 08	5 4	30 4	22 4		17 1	8 8	52 3			42 3	34 1		71 3	17 2		4 9	61 1		22
Averages Females		28	145 4		55 57	18 0	14 5		11 0	15 23		14	17 1	4 1	11 4	94 9	78 9	5 3	3 7	63 99	5 1	28 3	20 5		15	7 75	48 8	21 4	8 9	41 4	33 1		72 6	17 9	5 2	3 5	53 7	31 1	9 1

INSPECTION RECORD OF MACHIGANGA INDIANS

		Skin	Hair				Moustache and beard		Eyes													
No.	Sex	Color	Color	Character	Gray	Lost	Color	Character	Iris	Conjunctiva	Forehead	Supraorbital ridges	Eye-slits	Malars	Nasion depression	Nose	Nasal septum	Lips	Alveolar prognathism	Chin	Angle of lower jaw	Breasts
201	M.	Medium brown	All a dull rusty black	Wavy	None	None	Black	Sparse	Dark brown	Yellowish	+Medium	+Medium	I. C. L.*	Pronounced	Shallow	Straight	Medium inc. up	+Medium	+Medium	—Medium	—Medium	....
202	M.	Reddish brown		Wavy	None	None	None	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Convex	Slightly inc. up	+Medium	Medium	Medium	Medium	....
203	M.	Reddish brown		Straight	None	None	....	Sparse	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Convex	Inclined up	Medium	+Medium	—Medium	+Medium	....
204	M.	Reddish brown		Straight	None	None	....	Sparse	Dark brown	Yellowish	Medium	+Medium	I. C. L.	Pronounced	Shallow	Convex	Horizontal	+Medium	Medium	—Medium	+Medium	....
205	M.	Reddish brown		Wavy	None	Few	Black	Sparse	Dark brown	Yellowish	+Medium	Medium	I. C. L.	Medium	Shallow	Concave	Slightly inc. up	Medium	Medium	Medium	+Medium	....
206	M.	Reddish brown		Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	Medium	I. C. L.	+Medium	Shallow	Slightly convex	Inclined up	Medium	Medium	—Medium	—Medium	....
207	M.	Reddish brown		Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	+Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Inclined up	+Medium	+Medium	—Medium	+Medium	....
208	M.	Reddish brown		Straight	None	None	None	....	Dark brown	Yellowish	+Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Slightly inc. up	+Medium	+Medium	Medium	+Medium	....
209	F.	Reddish brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Straight	Slightly inc. up	+Medium	Medium	—Medium	+Medium	Conical
210	F.	Reddish brown		Straight	None	None	....	....	Dark brown	Yellowish	+Medium	Medium	I. C. L.	Pronounced	Shallow	Convex	Slightly inc. up	+Medium	Medium	Medium	+Medium	Conical
211	F.	Reddish brown		Straight	None	None	....	....	Dark brown	Yellowish	+Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Slightly inc. up	Medium	Medium	—Medium	Medium	Conical
212	F.	Reddish brown		Straight	None	None	....	....	Dark brown	Yellowish	+Medium	Medium	I. C. L.	Pronounced	Shallow	Straight	Slightly inc. up	Medium	Medium	Medium	+Medium	Conical
213	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	—Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Slightly inc. up	+Medium	Medium	—Medium	+Medium	Flat
214	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Convex	Slightly inc. d.	+Medium	Medium	Medium	+Medium	Conical
215	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Inclined up	+Medium	Medium	—Medium	+Medium	Pendulous conical
216	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly concave	Slightly inc. d.	+Medium	Medium	Medium	+Medium	Conical
217	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Straight	Slightly inc. up	+Medium	Medium	Medium	+Medium	Conical
218	M.	Reddish brown		Straight	None	None	Black	Sparse	Dark brown	Yellowish	+Medium	+Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Slightly inc. up	+Medium	Medium	—Medium	Medium	....
219	M.	Reddish brown		Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Straight	Slightly inc. up	+Medium	Medium	Medium	+Medium	....
220	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly concave	Slightly inc. up	Medium	Medium	Medium	+Medium	Flat
221	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly concave	Horizontal	Medium	+Medium	Medium	+Medium	Flat
222	M.	Medium brown		Straight	None	None	None	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Slightly inc. up	+Medium	Medium	Medium	+Medium	....
223	M.	Medium brown		Straight	None	Few	Some gray	Sparse	Dark brown	Yellowish	Medium	+Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Horizontal	Medium	Medium	Medium	+Medium	....
224	M.	Medium brown		Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Slightly inc. d.	Medium	Medium	Medium	+Medium	....
225	M.	Medium brown		Straight	None	None	Black	Very sparse	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Slightly inc. up	Medium	Medium	Medium	Medium	....
226	M.	Medium brown		Straight	None	None	Black	Very fine	Dark brown	Yellowish	Medium	+Medium	I. C. L.	Pronounced	Shallow	Medium convex	Horizontal	+Medium	Medium	Medium	+Medium	....
227	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	+Medium	Shallow	Slightly convex	Slightly inc. up	Medium	+Medium	+Medium	+Medium	Conical
228	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Slightly inc. d.	Medium	Medium	Medium	+Medium	Prominent conical
229	M.	Medium brown		Straight	None	None	Black	Very fine	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Horizontal	Medium	Medium	Medium	+Medium	....
230	M.	Medium brown		Straight	None	None	Black	Sparse	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Moderate convex	Slightly inc. up	Medium	Medium	Medium	+Medium	....
231	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Convex	Slightly inc. up	+Medium	Medium	Medium	+Medium	Pendulous conical
232	F.	Medium brown		Straight	None	None	....	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Straight	Slightly inc. up	+Medium	Medium	—Medium	Medium	Conical
233	M.	Medium brown		Straight	None	None	None	....	Dark brown	Yellowish	Medium	Medium	I. C. L.	Pronounced	Shallow	Slightly convex	Slightly inc. up	+Medium	Medium	Medium	+Medium	....

* Inner Canthus Lower.

INDIVIDUAL MEASUREMENTS AND INDICES MACHIGANGA INDIANS

Number	Sex	Approximate age	Height	Max. finger reach	Excess of finger reach over height	Sitting height	Sitting height per cent of total height	Head: d. ant. post.	D. lateral max.	Cephalic index	Height line bet. aud. meati to bregma	Cephalic module	Cephalic module and height
201	M.	..	162.7	163.5	0.8	85.7	52.67	18.7	14.7	78.61	12.6	15.33	94.2
202	M.	..	156.5	158.3	1.8	82.2	52.52	17.6	14.0	79.55	12.5	14.70	93.9
203	M.	..	154.6	151.8	—2.8	67.6	43.73	18.1	14.3	79.01	12.9	15.10	97.7
204	M.	..	158.4	160.9	2.5	80.6	50.88	18.7	14.4	77.01	12.0	15.03	94.9
205	M.	..	153.0	159.0	6.0	77.1	50.39	18.8	14.2	75.53	12.7	15.23	99.5
206	M.	..	153.4	155.8	2.4	77.7	50.65	17.2	14.4	83.72	12.3	14.63	95.4
207	M.	..	158.4	162.2	3.8	79.4	50.13	18.7	14.9	79.68	12.5	15.37	97.0
208	M.	..	155.6	159.7	4.1	83.5	53.66	18.2	14.7	80.77	13.0	15.30	98.3
209	F.	..	144.8	138.8	—6.0	76.5	52.83	17.4	13.9	79.89	12.9	14.73	101.7
210	F.	..	140.7	141.0	0.3	70.8	50.32	16.8	13.8	82.14	12.8	14.47	102.8
211	F.	..	148.2	151.4	3.2	71.8	48.44	17.4	15.0	86.21	12.9	15.10	101.9
212	F.	18	147.6	146.0	—1.6	69.6	47.15	17.3	13.3	76.88	12.8	14.47	98.0
213	F.	35	144.4	144.8	0.4	74.7	51.73	17.4	14.2	81.61	12.8	14.80	102.5
214	F.	..	153.0	152.1	—0.9	84.5	55.23	18.3	14.2	77.60	12.9	15.13	98.8
215	F.	..	115.3	113.8	—1.5	76.2	66.09	16.8	14.3	85.12	12.6	14.57	126.4
216	F.	..	143.2	142.6	—0.6	75.9	53.00	17.8	13.7	76.97	13.0	14.83	103.6
217	F.	..	146.4	143.2	—3.2	74.7	51.02	17.0	13.9	81.76	12.5	14.47	98.8
218	M.	..	157.2	157.0	—0.2	79.1	50.31	17.9	14.3	79.89	12.9	15.03	96.6
219	M.	..	156.5	153.0	—3.5	78.4	50.10	18.6	13.7	73.66	12.9	15.07	95.9
220	F.	..	141.9	152.1	10.2	74.0	52.15	16.9	14.2	84.02	12.8	14.63	103.1
221	F.	..	144.1	143.5	—0.6	71.8	49.83	17.4	14.0	80.46	12.9	14.77	102.5
222	M.	..	153.0	152.1	—0.9	74.0	48.37	17.8	14.3	80.34	13.1	15.07	98.5
223	M.	..	152.1	147.0	—5.1	71.7	47.14	17.2	14.8	86.05	12.9	14.97	98.4
224	M.	..	156.2	154.3	—1.9	81.9	52.43	18.0	15.6	86.67	13.4	15.67	100.3
225	M.	..	150.5	145.4	—5.1	70.2	46.64	18.3	14.8	80.87	13.0	15.37	102.1
226	M.	..	161.0	152.4	—8.6	79.4	49.32	18.6	14.4	77.42	13.3	15.43	95.8
227	F.	..	146.4	140.7	—5.7	74.0	50.55	17.6	14.2	80.68	12.5	14.77	100.9
228	F.	..	151.1	142.9	—8.2	72.1	47.72	17.4	14.2	81.61	13.0	14.87	98.4
229	M.	..	155.9	156.8	0.9	81.9	52.53	18.2	14.4	79.12	13.0	15.20	97.5
230	M.	..	158.8	161.9	3.1	83.5	52.58	18.0	15.0	83.33	13.1	15.37	96.8
231	F.	..	148.6	138.7	—9.9	74.3	50.00	17.6	14.1	80.11	12.8	14.83	99.8
232	F.	..	143.2	144.8	1.6	72.8	50.84	17.0	14.5	85.29	12.9	14.80	103.4
233	M.	..	152.7	154.9	2.2	72.7	47.61	17.3	14.8	85.55	13.0	15.03	98.4
Averages Males ...		..	155.9	155.9	0.0	78.1	50.09	18.1	14.5	80.38	12.8	15.16	97.3
Averages Females...		..	143.9	142.4	—1.5	74.2	51.79	17.3	14.1	81.36	12.8	14.75	102.8

Number	Sex	Face: Menton-nasion	Menton-crinion	Height of forehead (nasion-crinion)	Diam. bizygom. max.	Facial index: Morphologic	Facial index: Physiognomic	Nose: height to nasion	Nose: width max.	Nasal index	Mouth breadth	Chest: D. lateral	Chest: D. ant. post.	Chest: Index
201	M.	12.6	18.4	5.8	15.0	84.0	81.5	4.4	4.9	111.36	6.6	27.0	22.5	83.33
202	M.	11.6	17.3	5.7	13.7	84.7	79.2	5.0	3.8	76.00	5.6	26.2	21.8	83.21
203	M.	12.2	18.2	6.0	14.1	86.5	77.5	4.9	4.3	87.76	5.4	28.1	23.9	85.05
204	M.	13.0	18.8	5.8	14.0	92.9	74.5	5.8	4.6	70.31	5.9	28.8	22.4	77.78
205	M.	12.5	19.0	6.5	13.7	91.2	72.1	5.7	4.4	77.19	5.9	27.3	20.4	74.73
206	M.	12.6	17.0	4.4	13.7	92.0	80.6	5.7	3.9	68.42	5.1	26.5	20.7	78.11
207	M.	13.3	18.7	5.4	14.4	92.4	77.0	5.4	4.5	83.33	6.4	30.6	23.4	76.47
208	M.	12.0	17.4	5.4	14.8	81.1	85.1	4.8	4.6	95.83	6.3	29.6	24.9	84.12
209	F.	11.0	15.9	4.0	13.8	79.7	86.8	4.2	4.0	95.24	5.5	27.6	22.2	80.43
210	F.	11.2	16.7	5.5	12.6	88.9	75.45	4.4	3.7	84.09	4.4	26.1	20.3	77.78
211	F.	11.9	17.2	5.3	13.2	90.15	76.7	4.7	3.9	82.98	5.6	25.1	20.5	81.67
212	F.	11.0	17.1	6.1	13.2	83.3	77.2	4.3	3.4	79.07	5.0	26.9	24.4	90.71
213	F.	11.8	16.8	5.0	13.3	88.7	79.2	4.8	4.1	85.42	6.0	25.4	18.6	73.23
214	F.	10.9	16.8	5.9	14.1	77.3	83.9	4.8	3.7	77.08	5.5	27.5	21.9	70.64
215	F.	11.4	15.6	4.2	13.3	85.7	85.3	4.8	3.3	68.75	5.1	27.3	20.8	76.19
216	F.	11.0	15.6	4.6	13.2	83.3	84.6	4.5	4.1	91.11	5.8	27.8	19.4	69.78
217	F.	11.9	17.3	5.4	13.4	88.8	77.5	5.1	3.7	72.55	5.3	26.3	18.8	71.48
218	M.	12.2	18.0	5.8	13.9	87.8	77.2	4.3	4.4	102.33	5.9	28.3	21.1	74.56
219	M.	12.4	17.3	4.9	14.2	87.3	82.1	5.1	4.5	88.24	6.4	27.3	22.7	83.15
220	F.	12.4	17.6	5.2	13.2	93.9	75.0	5.2	4.6	88.46	5.5	25.5	23.6	92.55
221	F.	12.0	16.6	4.6	13.8	87.0	83.1	3.8	3.7	97.37	4.9	24.4	21.5	88.11
222	M.	12.2	16.9	4.7	13.7	89.05	81.1	4.6	4.0	86.96	5.4	28.7	21.2	73.87
223	M.	12.0	17.1	5.1	14.3	83.9	83.6	4.9	4.4	89.80	5.7	26.0	21.2	81.54
224	M.	13.2	19.2	6.0	14.6	90.4	76.0	4.9	4.0	81.63	5.9	28.0	21.5	76.79
225	M.	12.0	16.8	4.8	13.5	88.9	80.4	5.1	3.7	72.55	6.0	25.6	20.8	81.25
226	M.	12.4	17.5	5.1	13.6	91.2	77.7	4.8	3.9	81.25	5.3	27.2	22.1	81.25
227	F.	11.6	16.5	4.9	13.3	87.2	80.6	4.6	4.2	91.30	5.2	26.7	20.2	75.66
228	F.	12.2	15.8	3.6	13.6	89.7	86.1	4.6	3.6	78.26	5.4	27.5	21.7	78.91
229	M.	12.5	18.2	5.7	14.1	88.7	77.5	4.7	4.0	85.11	5.9	27.2	21.8	80.15
230	M.	12.2	17.7	5.5	14.5	84.1	81.9	5.1	4.1	80.39	5.8	26.5	21.8	82.26
231	F.	12.3	17.5	5.2	13.0	94.6	74.3	4.5	3.6	80.00	5.1	25.2	18.9	75.00
232	F.	11.6	16.7	5.1	13.2	87.9	79.0	4.6	3.8	82.61	5.1	24.2	19.0	78.51
233	M.	13.3	16.7	3.4	13.9	95.7	83.2	4.6	4.1	89.13	5.3	26.4	18.8	71.21
Averages Males ...		12.5	17.8	5.3	14.1	88.4	79.3	5.0	4.2	85.37	5.8	27.5	21.8	79.38
Averages Females...		11.6	16.6	5.0	13.3	87.1	80.3	4.6	3.8	83.62	5.3	26.2	20.8	79.31

Number	Sex	Left hand: Length	Left hand: Width	Left hand: Index	Left foot: Length	Left foot: Width	Left foot: Index	Left leg circum. max	Left ear: Height	Left ear: Breadth	Left ear: Index	Hand pressure: Right	Hand pressure: Left
201	M.	17.1	9.0	52.6	24.5	10.0	40.8	34.6	7.1	4.0	56.3	28	35
202	M.	16.6	7.8	47.0	22.7	8.9	39.2	31.1	5.9	3.6	61.0	24	17
203	M.	16.2	8.3	51.2	21.6	9.2	42.6	32.4	5.9	3.5	59.3	23	26
204	M.	15.1	7.8	51.7	22.9	10.0	43.7	29.2	6.4	3.9	60.9	21	23
205	M.	16.2	7.7	47.5	21.6	9.4	43.5	28.9	6.8	4.1	60.3	19	14
206	M.	15.7	8.2	52.2	23.2	8.4	36.2	30.8	6.2	3.7	59.7	24	23
207	M.	18.3	8.4	45.9	23.8	9.7	40.8	35.9	6.1	4.1	67.2	33	38
208	M.	17.3	8.8	50.9	23.5	11.4	48.5	36.5	5.9	4.9	83.1	25	28
209	F.	15.5	7.8	50.3	21.7	8.8	40.55	33.7	6.4	3.6	56.25	11	15
210	F.	14.7	6.9	46.9	20.9	8.3	39.7	31.1	5.5	3.7	67.3	14	9
211	F.	15.4	6.9	44.8	20.7	8.3	40.1	26.7	5.6	3.7	66.1	17	11
212	F.	15.8	7.6	48.1	20.6	8.3	40.3	31.4	6.0	3.5	58.3	12	8
213	F.	15.4	7.2	46.75	20.6	8.7	42.2	27.0	5.9	3.6	61.0	10	8
214	F.	16.6	8.1	48.8	21.9	9.7	44.3	34.0	6.4	3.8	59.4	22	13
215	F.	14.2	7.2	50.7	18.4	8.0	43.5	31.1	5.5	3.5	63.6	7	6
216	F.	15.3	7.2	47.1	20.0	8.2	41.0	33.7	5.5	3.4	61.8	13	7
217	F.	16.2	7.6	46.9	20.3	8.7	42.9	33.3	5.4	3.4	63.0	12	12
218	M.	17.0	8.6	50.6	23.7	10.4	43.9	35.2	6.5	4.1	63.1	26	23
219	M.	17.2	8.7	50.6	23.2	10.3	44.4	32.7	6.4	3.9	60.9	17	15
220	F.	16.8	7.8	46.4	21.8	8.4	38.5	32.7	7.4	3.4	45.9	10	9
221	F.	16.0	7.2	45.0	21.3	8.4	39.4	28.6	6.2	3.9	62.9	12	12
222	M.	15.6	7.5	48.1	22.0	8.8	40.0	32.7	6.0	3.8	63.3	16	12
223	M.	16.3	7.7	47.2	22.1	8.6	38.9	29.2	5.9	3.4	57.6	17	13
224	M.	16.4	8.9	54.3	22.4	10.2	45.5	34.0	6.5	3.6	55.4	25	25
225	M.	15.6	7.5	48.1	22.2	9.6	43.2	29.2	5.5	3.4	61.8	15	19
226	M.	16.9	7.8	46.2	24.4	9.7	39.75	32.7	6.2	3.9	62.9	14	14
227	F.	15.3	6.9	45.1	20.2	8.3	41.1	28.9	6.0	3.3	55.0	8	13
228	F.	15.3	7.4	48.4	21.0	8.2	39.05	31.4	5.9	3.8	64.4	16	14
229	M.	15.8	7.4	46.8	22.1	8.9	40.3	34.3	6.4	3.7	57.8	29	22
230	M.	16.2	8.1	50.0	22.5	9.2	40.9	32.7	6.3	4.0	63.5	27	27
231	F.	15.5	7.2	46.45	19.8	8.2	41.4	30.5	5.9	3.7	62.7	15	10
232	F.	15.0	7.4	49.3	20.1	8.4	41.8	29.5	5.4	3.4	63.0	13	9
233	M.	16.1	7.6	47.2	23.8	9.5	39.9	30.2	5.9	3.5	59.3	11	9
Averages Males ...		16.4	8.1	49.3	22.9	9.6	41.8	32.35	6.2	3.8	61.86	21.9	21.3
Averages Females...		15.5	7.4	47.4	20.6	8.5	41.0	30.9	5.9	3.6	60.7	12.8	10.4

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The Genus Riccardia In Chile

BY

ALEXANDER W. EVANS

NEW HAVEN, CONNECTICUT
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THE GENUS RICCARDIA IN CHILE

Alexander W. Evans

I. INTRODUCTION

The genus *Riccardia,* often known as *Aneura,* is well represented in Chile, especially along the moist western coast south of Valdivia and in the adjacent Magellan Territory, formerly a part of Patagonia. As long ago as 1844 Hooker and Taylor (**14**, p. 479) listed four species from the region, all having been collected by Hooker on Hermite Island, close to Cape Horn. Two of these species were described as new, under the names *Jungermannia alcicornis* and *J. prehensilis*, and have been accepted without question by subsequent writers on the Hepaticae. The other two species, both listed under *Jungermannia,* were *R. multifida* (L.) S. F. Gray and *R. pinguis* (L.) S. F. Gray, originally based on European material but now known to be widely distributed, especially in northern regions. Although later writers have again reported these two species from Chile, it is doubtful if either is actually a member of the flora. Three years later *J. alcicornis* and *J. prehensilis* were redescribed and figured in the Flora Antarctica (**34**, p. 445, *pl. 160, f. 8, 9*).

Meanwhile, in 1845, Montagne (**17**, p. 214) had listed the West Indian *"Metzgeria fucoides,"* which is really a species of *Riccardia,* from the Straits of Magellan; and, in 1846, the authors of the Synopsis Hepaticarum (**13**, pp. 495 and 505) had recorded *Aneura pinguis* from Chile and had described a var. *chilensis* of *"Metzgeria eriocaula,"* likewise a species of *Riccardia.* The typical form of this species grows in New Zealand, but the variety was based on a Chilean specimen in the Montagne Herbarium, collected by C. Gay. *"Metzgeria fucoides"* has not again been reported from Chile and it is doubtful if it occurs there. The var. *chilensis,* however, again appears in a work by Montagne published in 1850 (**18**, p. 298), and another species of *Riccardia* is there reported from Concepcion under the name *"Metzgeria Poeppigiana"* (p. 299). This last species was originally described by Lehmann and Lindenberg from Peru and St. Vincent, under the name *Jungermannia Poeppigiana*, and the Synopsis cites it also from Mexico. It has not been reported from Chile since the time of Montagne, and its occurrence there is at least questionable. The status of the var. *chilensis* will be subsequently considered. In addition to these species of "*Metzgeria*" Montague reported both *Aneura pinguis* and "*A. pinnatifida*" from Chile. The latter species, as will be shown later, is variously understood even at the present time.

In 1872 Ångström (1, p. 13) listed *R. alcicornis* and *R. prehensilis* (under the generic name *Jungermannia*) from Port Famine, Straits of Magellan, but nothing further was added to our knowledge of the Chilean species of *Riccardia* until 1885, when Massalongo (16) published an account of the Hepaticae collected by C. Spegazzini on Tierra del Fuego and some of the neighboring islands. Although a few of the specimens which he recorded came from Argentine territory, they naturally belong in the same floristic region as southern Chile. Massalongo described and figured the following new species: *R. fuegiensis*, *R. Spegazziniana* and *R. spinulifera*. The first of these has since been repeatedly collected and is one of the most distinctive species of the whole genus; the other two species are likewise distinctive but are less conspicuous and their distribution is less completely known. Massalongo likewise gave new stations for *R. prehensilis* and cited "*R. pinnatifida* (Schw.)" from Staten Island (east of Tierra del Fuego). Four years later Bescherelle and Massalongo (2) published an account of the Hepaticae collected by Savatier and other members of the French Mission to Cape Horn. The following species of *Riccardia* were included: *R. eriocaula* var. *chilensis*, *R. fuegiensis*, *R. pinguis*, *R. prehensilis*, *R. Spegazziniana* and *R. spinulifera*. The first of these, which is cited from several localities, is compared with *R. prehensilis* and with the typical form of *R. eriocaula* from New Zealand.

In the following year, 1890, Schiffner (19) gave a full report on the Hepaticae collected in the vicinity of the Straits of Magellan by Dr. Naumann, botanist of the "Gazelle" Expedition. The following eight species among those he recorded would now be included under *Riccardia*: *Aneura calva*, *A. multifida*, *A. pinnatifida*, *A. umbrosa*, *Pseudoneura crispa*, *P. fuegiensis*, *P. prehensilis* and *Spinella magellanica* (the last being based on Massalongo's *Ric-*

cardia spinulifera). Of these species *Aneura calva*, *A. umbrosa* and *Pseudoneura crispa* were proposed as new. In connection with *P. prehensilis* Schiffner expressed the opinion that this species and *P. eriocaula* were scarcely distinct, and he stated further that some of the specimens referred by Bescherelle and Massalongo to the var. *chilensis* were indistinguishable from some of Spegazzini's specimens of *P. prehensilis*.

In 1893 Stephani (**26**, pp. 21, 26) published two new species of *Riccardia* from the Straits of Magellan under the names *Aneura granulata* and *A. Savatieri*. The first of these (as appears from a later publication) was based (at least in part) on a Staten Island specimen collected by Spegazzini; the second, on a specimen collected by Savatier and referred by Bescherelle and Massalongo to *Riccardia prehensilis*. Stephani at first implied that *Aneura prehensilis* was restricted to New Zealand; later in the same year, however (**26**, pp. 137, 138), he cited it from the Straits of Magellan only.

Meanwhile, in 1892, the writer (**8**) had cited *Aneura multifida* doubtfully and *A. fuegiensis* definitely from southern Patagonia, basing these records on specimens collected by the "Albatross" Expedition. Six years later (**9**), in his report on the Hepaticae collected by J. B. Hatcher in the same region, five species of *Riccardia* were included, as follows: *Aneura calva*, *A. crispa*, *A. fuegiensis*, *A. prehensilis* and *A. Spegazziniana*. The anatomical structure of *A. prehensilis* was described in some detail and among its synonyms Stephani's *A. Savatieri* was included. It will be shown in the present paper that this reduction to synonymy was unwarranted, and that two of the other determinations made by the writer need to be revised. The report on the Hatcher collection was republished in 1903 (**10**).

In 1899 Stephani (**27**) published a monograph of the genus *Aneura* and described the following new species from Chilean territory: *A. autoica*, *A. conimitra*, *A. corralensis*, *A. floribunda*, *A. Negeri*, *A. pallidevirens*, *A. spectabilis* and *A. tenax*. In the same work he accepted the reduction of his *A. Savatieri* to synonymy under *A. prehensilis* and cited the following nine species of the genus from Chile, in addition to his eight new species, thus making seventeen in all: *A. alcicornis*, *A. calva*, *A. crispa* (under which *A. umbrosa* is included as a synonym), *A. fuegiensis*, *A.*

granulata, A. prehensilis, A. Spegazziniana, A. spinulifera, and *A. stolonifera* Steph. (a species based on Australian specimens). He does not include *A. eriocaula, A. multifida,* or *A. pinnatifida.* With the exception of *A. Negeri,* Stephani's new species were all based, either wholly or in part, on material collected by P. Dusén. In 1900 and 1901 (**28, 29**) he published special papers on Dusén's collections, in which the localities for these new species were given in greater detail, and in these papers reinstated *A. eriocaula* and *A. pinnatifida* as members of the Chilean flora. He likewise included two species, *A. fragilis* and *A. pulvinata,* which seem to be nothing more than *nomina nuda* and which therefore deserve no further attention. In an independent paper on the vegetation of Patagonia Dusén himself (**7**) described the habitats of some of the species of *Riccardia,* which he had found, from an ecological standpoint.

In another paper, likewise published in 1901 (**30**), Stephani listed the Hepaticae collected by Racovitza during the voyage of the "Belgica"; *Aneura crispa, A. floribunda* and *A. spectabilis* are included. In a later paper, published in 1905 (**31**), he gave an account of the hepatics collected by C. Skottsberg during the Swedish South Polar Expedition of 1901-03. Among the four species of *Riccardia* which he listed from Tierra del Fuego it is of interest to note that he included *A. multifida,* a species which he had excluded in 1899; the other three species were *A. floribunda, A. pinnatifida* and *A. tenax.*

A much more extensive paper (**32**) on the Hepaticae of southern South America was published by Stephani in 1911. It was based on the large collections made mainly by Skottsberg during the Swedish Expedition of 1907-09 to Patagonia and Tierra del Fuego. In this paper nineteen Chilean species of *Aneura* are included, of which the following are described as new: *A. chilensis, A. crassicrispa, A. fuscobrunnea, A. profunda, A. spiniloba, A. subnigra,* and *A. tenerrima.* The remaining twelve species need not be listed here, since all are found in Stephani's earlier papers. In 1916 Skottsberg (**22**) described the ecological relationships of many of the species he had collected. Stephani's last paper dealing with Chilean Hepaticae (**33**) appeared in 1917. The new *Aneura* species of the Skottsberg collection were here redescribed, and two other species, *A. Lindaviana* and *A. nudimitra,* were proposed as new. The first was based on a specimen collected by Reiche in southern Chile; the second, on a specimen collected by Hariot on Clarence Island (west of Tierra del Fuego).

According to his writings Stephani accepts twenty-nine species of *Riccardia* as members of the Chilean flora. If *A. Savatieri* is reinstated as a species, and if *A. fucoides, R. pinguis* and *A. Poeppigiana* are added, a total of thirty-three species is obtained. In the writer's opinion, however, seven of these species are reported on insufficient evidence and four of Stephani's species ought to be reduced to synonymy. This would leave a residue of only twenty-two species. To these should be added the three species proposed as new in the present paper, thus raising the total to twenty-five. In all probability other species remain to be discovered. In fact at least two species have come to light which do not agree with any of those included but of which the material is too fragmentary for description. It should be noted further that ten of the species are known from a single collection each and that even the largest and most conspicuous species are still inadequately understood.

Through the kindness of correspondents, the writer has had the unusual privilege of studying original or authentic specimens of nearly every Chilean species of *Riccardia*. Especial thanks are due to the curators of the botanical museums at Upsala and Stockholm, where Dusén's and Skottsberg's material is deposited; to the curator of the Boissier Herbarium, which includes the extensive collection of Stephani; and to the curator of the New York Botanical Garden, who has in his charge the very representative Mitten Herbarium. A valuable collection of Chilean Hepaticae made by Professor Roland Thaxter of Harvard University has likewise been available for study; and important specimens have been received from Professor Massalongo of Verona and Professor Schiffner of Vienna. To all who have aided him in his work the author would here express his sincere thanks.

II. GENERIC CHARACTERS

The generic characters of *Riccardia* are clearly given by Spruce (23, p. 540), Stephani (27), and other writers, especially by those who have taken the tropical, south temperate, and antarctic species into consideration. At the same time it seems advisable to precede the detailed descriptions of the Chilean species by a discussion of the more important features of the genus as a whole.

From the standpoint of morphology *Riccardia* is of unusual interest. Its least differentiated species are among the simplest of all thalloid hepatics. In forms like these, of which *R. pinguis* may be taken as an example, the gametophyte consists of a flat, dorsiventral thallus with unlimited growth, in which differentiation is reduced to a minimum. In other words the branches, which are invariably lateral, if they develop beyond a rudimentary condition, are essentially like the axis and eventually give rise to new thalli with the progressive death of the older parts of the plant. In such a type the entire vegetative thallus carries on the photosynthetic function. Its dorsiventrality is expressed first of all by the rhizoids and slime-papillae, which are confined to the ventral surface. The rhizoids arise irregularly, apparently in response to external factors, but the slime-papillae are borne in regular acropetal succession, a single papilla (in most cases at least) being associated with each of the segments cut off by the "two-sided" apical cell (see, in this connection, Miss Clapp, 6, p. 180). Except by the position of the rhizoids and slime-papillae the dorsiventrality of the thallus is very slightly indicated. The cells of the upper surface-layer are smaller and greener than the others, but these are the only cells at all differentiated, and the cell-walls throughout the entire thallus are thin or only slightly thickened. Toward the margin the thallus thins out gradually until it is only one cell thick, but the marginal portion is like the rest and shows no indication of a wing or a differentiated row of marginal cells.

In sharp contrast to these simpler types are those in which the thallus shows a high degree of complexity, not only in outward form but also in histological differentiation. Yet these complicated types retain the rather meager equipment found in *R. pinguis* of a dorsiventral thallus with constantly lateral branching, and the majority agree further in lacking appendicular organs in the vegetative axes with the exception of the rhizoids and slime papillae. Their complexity in outward form is brought about by the development of more than one kind of axis, the branches being clearly differentiated from the main axis and showing a further differentiation when compared with one another. The Javan *R. hymenophylloides* Schiffn. (20, p. 54) may be taken as an example. In this remarkable plant, as described and figured so clearly by Goebel (11, p. 280, *f. 177, 178*) the thallus shows a subterete axis with rounded edges, unlimited growth, and no indication of wings. The primary branches, however, which arise in subopposite pairs at fairly regular intervals along the main axis, are soon limited in their growth and show a broad median region three or four cells thick, sharply set off from equally broad unistratose wings. These primary branches bear closely crowded secondary branches, likewise limited in growth, in which a further differentiation in the same direction manifests itself, the median portion being reduced in width and the wings increased. The primary and secondary branches form branch-systems to which the function of photosynthesis is largely restricted. The axis on the contrary, as emphasized by Goebel, is largely mechanical in its function but also plays a part in certain processes connected with nutrition, such as the storage and transportation of foods.

In *R. hymenophylloides* the axis is prostrate and partakes to a certain extent of the nature of a creeping caudex or rhizome. But in *Aneura fucoides*, where the axis is erect in older plants, the same type of differentiation is present, and the basal part of the axis often gives off another type of branch in the form of stolons, the function of which is to affix the plant to the substratum. The stolons resemble the axis in being subterete and wingless, but their branching is sparse and irregular, the branches representing new stolons. Goebel has likewise figured the thallus of *A. fucoides* (11, *f. 152, 153*) and emphasizes the fact that the stolons are not organs *sui generis*. They are merely modifications of photosynthetic branches, and a direct change from such a branch into a stolon can sometimes be observed.

The histological differentiation in such complicated types is perhaps most strongly marked in the main axis. As an expression of their mechanical function there is present a distinct sclerotic tissue in the form of a hollow cylinder and composed of long cells, usually pointed at the ends, with thick and often pigmented walls. A cylinder of this type was first described by Leitgeb in the case of *R. eriocaula* (**15**, p. 49). It is never superficial in position but is bounded on the outside by one or two layers of short cells with thinner walls, the diameter of which often equals or exceeds that of the sclerotic cells. On the inside the sclerotic cylinder passes by a gradual or abrupt transition into a central core composed of paler and often colorless cells with thinner walls. In the photosynthetic branches the sclerotic tissue persists in a reduced form, the cells being fewer and having more delicate walls; in the ultimate branches these cells usually occupy the entire interior of the thickened median portion, the central core of the axis having tapered to an end in the larger branches. The cells which form the unistratose wings of typical photosynthetic branches and also the surface-cells of the median portion are usually broader than the interior cells and often show distinct trigones. In a general way the stolons resemble the main axis but the sclerotic tissue is only vaguely indicated. In accordance with their function the stolons usually produce rhizoids in abundance, and the remaining parts of the thallus may be entirely free from them.

Another type of cell-differentiation is shown by species which produce special appendicular outgrowths or organs, in addition to the rhizoids and slime papillae. The simplest of these, too simple perhaps to be called outgrowths at all, are in the form of local wall-thickenings of the surface-cells. They may be exceedingly irregular or may give rise to low anastomosing ridges, having the effect of teeth when seen in profile. Such thickenings are found in the Javan *R. scabra* Schiffn. (**20**, p. 41) and in Stephani's *Aneura stolonifera* of Australia and New Zealand (see **25**, p. 265, *pl.* 26, *f. 3*). Among the Chilean species *R. granulata* shows them in an unusually pronounced form (FIG. 13, F-H).

Somewhat more definite than the wall-thickenings are the low outgrowths formed by the projections of individual cells. On the margin these cells may give the effect of crenulations or denticulations, as in *R. multifida* and *R. Thaxteri* (see FIG. 2, H); on the surface, as in *R. hymenophylloides*, they produce a slightly roughened appearance and doubtless play a part, as suggested by Goebel, in the retention of water. Outgrowths of this type are seen with especial clearness in the Chilean *R. prehensilis* (FIG. 1, D, E), where every surface-cell (except on the stolons) projects forward in the form of a papilla, thus giving the whole surface a velvety appearance.

A higher type of appendage is present in cases where entire cells are involved, and an excellent example of this condition is found in *R. eriocaula*. At first sight the surface appears velvety, much as in *R. prehensilis,* but the appearance here is due to distinct, colorless papilliform cells cut off by cell-walls. On the axis these cells are closely crowded, but on the ultimate branches they are more scattered and show their true nature more clearly. It is of course possible that the continuous layer of cells with papilliform projections found in *R. prehensilis* might be derived from the condition found in *R. eriocaula* by crowding the cells together so closely that they coalesced. Unfortunately there is little to support this view, except that the papillae in both species are hyaline.

Unicellular outgrowths lead to conditions where the cells cut off form more complicated structures involving two to many cells. Multicellular outgrowths of this type are seen in a very irregular arrangement in *R. spinulifera,* which in other respects is a rather simply organized plant. They reach their highest expression, however, in *R. fuegiensis,* where they form longitudinal lamellae on the ventral surface of the thallus and arise in distinct acropetal succession. The appendages of the various Chilean species will be discussed in greater detail in connection with the specific descriptions.

Between the most highly complicated types of thallus found in *Riccardia* and the simplest types are all possible gradations; and it is an interesting fact that an intermediate type of thallus may show a high degree of differentiation in some respects and relative simplicity in others. In *R. spinulifera,* for example, complex appendages are associated with slight differentiation between the axis and its branches. In *R. autoica,* as will be shown, another combination presents itself. The thallus of this species (see especially FIG. 7, C) exhibits a vague differentiation into axis, photosynthetic branches and stolons, but the histological differences between these various structures are very slight indeed.

Although the majority of the species of *Riccardia* are dioicous, a few are monoicous, and a very few sometimes develop bisexual inflorescences. The sexual branches resemble the vegetative in being constantly lateral in position. In most cases the inflorescence is terminal and occupies the whole or nearly the whole of the branch, without of course involving the actual apical cell. Sometimes, however, the branch shows a sterile base, resembling an ordinary vegetative branch, and sometimes it continues its growth beyond the inflorescence in the form of a proliferation. The proliferation may be short and simple or may, at the other extreme, form a highly complicated branch-system. In such cases the inflorescence may come to occupy a distinctly lateral position on the branch, this being particularly true of female inflorescences. The sexual organs are borne on the dorsal surface and arise in strict acropetal succession, one being formed by each segment cut off from the apical cell. In this way the organs come to be situated in two longitudinal rows, those of one row alternating with those of the other. In most cases this arrangement is very clear but in *R. pinguis* the antheridia are sometimes in three or four irregular rows, and in many species the arrangement of the archegonia becomes indistinct by displacement. According to Miss Clapp (6, p. 181) the antheridia of *A. pinguis* arise in the usual way, one for each segment, so that an arrangement here in three or four rows must likewise be due to subsequent growth-displacements.

In a generalized type like *A. pinguis* the short male branches are fleshy, and the structure is not very different from that of an ordinary vegetative axis. Here, as elsewhere throughout the genus, each antheridium is in a deep depression, connected with the outside by a circular opening. Otherwise no distinctive protective structures are developed, although the thin margins of the branch are more or less crispate without forming wings. In most species, however, the male branches are more delicate in texture than the rest of the plant, and distinct wings from one to several cells wide are formed. These wings are sometimes spreading (see Figs. 9, E, and 11, F) but are often suberect or even connivent (see Figs. 6, E, and 7, H), and thus represent a true protective structure. In certain cases they are supplemented by bulging cells of the upper surface of the branch, or even by appendicular outgrowths, in case these are present elsewhere. Although in most cases the male branches are quickly limited in growth this is by no means invariably the case. Sometimes twenty or more antheridia are formed, the branch thus becoming greatly elongated. In most cases the branch which bears a male inflorescence is simple, but in a few species the male branch divides almost immediately into two or more subequal branches, each of which bears an inflorescence. This is strikingly the case in *R. Thaxteri* (FIG. 2, B) and *R. floribunda* (FIG. 12, A, B), where the inflorescences tend to form divaricate clusters.

The female branches, as a rule, are shorter than the male branches. In a few species, however, particularly in the absence of fertilization, more elongated female branches are developed, and an extreme case is found in *Aneura hymenophytoides* Spruce of Ecuador, where as many as twenty archegonia are sometimes present (see **23**, p. 542). Although the archegonia are borne on the dorsal surface of the branch, the latter is sometimes twisted in such a way that the archegonia are turned forward (toward the apex of the higher axis) rather than upward. The protective structures of the inflorescence are usually more complicated than in the case of the male inflorescence, although this is not always the case. The wing of the branch, for example, tends to be broader and to be dentate or laciniate (see FIGS. 2, I, 7, I, and 12, H), and a similar but narrower lamella is sometimes present between a wing and the archegonia (see FIG. 9, F); in other cases scattered teeth or cilia may be present among the archegonia. In case fertilization takes place a massive tubular protective organ develops around the young sporophyte (see FIGS. 2, A, and 10, A). This organ is usually described as a calyptra and this usage will be followed in the present paper. It has long been known, however, that only a small portion of this calyptra is derived from the ventral wall of the fertilized archegonium (see Leitgeb, **15**, p. 47). Most of it represents new tissue developed by a meristematic zone below the archegonium. The calyptra is therefore a lateral marsupium or perigynium, as Goebel has so clearly shown (**12**, p. 722, *f.* 705). Another remarkable feature is due to the fact that the neck-cells of the fertilized archegonia are likewise stimulated to renewed growth, although it is doubtful if they undergo division. The neck-cells increase markedly in size and their walls become thickened. They thus form at the tip of the calyptra a conical or rounded appendage known as a corona. In some species this corona is small and inconspicuous, while in others it is large and striking; but in any case it easily becomes detached as the sporophyte approaches maturity. Below the corona the surface of the calyptra varies greatly when different species are compared. Sometimes the surface remains smooth or nearly so but it is much more likely to become roughened, either through the splitting off of the superficial cells or through the presence of true appendicular outgrowths. It is not unusual, moreover, for one or more unfertilized archegonia to be carried up by the growth of the calyptra, although these usually remain in the basal portion.

The characteristic gemmae of *Riccardia* have long been known (see Goebel, **12**, p. 671, *f. 628*). They are in the form of oval two-celled bodies, which arise singly inside cells on the dorsal surface of the thallus or along the margin. When the gemmae are mature, the walls of the cells containing them are split, and the gemmae are set free. The branches bearing gemmae are slightly or not at all differentiated, so far as known, but they are usually quickly limited in their growth. Sometimes the gemmae are so abundantly produced that the branches seem to be covered over with a fine green dust.

The Chilean specimens studied have been too incomplete to throw much light on the structure of the sporophyte, but a few words regarding its distinctive features may be included. The capsule is of especial interest, owing to the comparatively small space occupied by the sporogenous tissue in the early stages of development. This space, as shown by Goebel and others (**11**, *f. 219;* **6**, *pl. 11, f. 142*), is in the form of a hollow sphere or ellipsoid open at the top. The interior is occupied by the young elaterophore, which extends through the apical opening of the mass of sporogenous tissue and becomes continuous with the young wall cells at the tip of the capsule. As development proceeds, the sporogenous tissue grows more rapidly than the elaterophore and occupies a much larger proportion of the space enclosed by the capsule wall. At maturity the wall dehisces in the usual way into four valves, each carrying at its tip a portion of the elaterophore. The cells of the latter have annular or half-annular thickenings in their walls, their free extremities often showing single spirals. In this respect they resemble the true elaters, which are long and pointed cells, each one usually with a single broad spiral band of thickening. The cells of the capsule wall are in two layers, and their structural features can be best demonstrated just before maturity. From a taxonomic standpoint the character and distribution of their wall-thickenings, which are nodular or in the form of half-rings, are of much interest. These thickenings, in the case of the European species of *Riccardia*, have been found to yield specific characters of much constancy. They would probably yield equally constant characters in the case of the Chilean species, and the lack of good capsules in the specimens available is therefore especially to be regretted.

III. DESCRIPTION OF SPECIES

Extreme types of *Riccardia,* such as *R. pinguis* and *R. hymenophylloides,* are so distinct that they might properly be separated generically, if they were not connected by intermediate types. The latter, which are very numerous, do not form a continuous series in which a gradual increase in complexity is exhibited. It has been shown, on the contrary, that complexity in certain features may be combined with simplicity in others, and combinations of this sort occur in the greatest variety. This condition makes it exceedingly difficult to arrange the species of the genus in natural groups, and nothing is attempted in the present paper except to place the more complex species at the beginning of the series and the less complex at the end. The key is artificial in character and is based entirely on vegetative features. In the citation of specimens the following abbreviations are used: B., Boissier Herbarium, at the University of Geneva; H., Cryptogamic Herbarium of Harvard University; M., Mitten Herbarium, at the New York Botanical Garden; Massal., collection of Professor Massalongo, at Verona; N. Y., Herbarium of the New York Botanical Garden; S., collection of Professor Schiffner, at Vienna; St., Herbarium of the Swedish Academy of Sciences, at Stockholm; U., Herbarium of Upsala University; U. S., United States National Herbarium; Y., Herbarium of Yale University (including the private collection of the author).

Key to the species

a. Main axis of thallus and its branches clearly differentiated and rarely intergrading — *b.*

a. Main axis of thallus and its branches slightly (or not at all) differentiated and often intergrading — *f.*

b. Thallus with numerous ventral longitudinal lamellae; main axis with a unistratose wing — 1. *R. fuegiensis* (p. 113).

b. Thallus without ventral lamellae; main axis without a unistratose wing — *c.*

c. Main axis subterete, at least in the lower part, the sides rounded in cross section — *d.*

c. Main axis distinctly flattened throughout, the sides acute to acuminate in cross section — *e.*

d. Thallus roughened throughout the greater part of its extent by rounded papillae, representing projections of surface-cells; ultimate branches with wings three cells thick
2. *R. prehensilis* (p. 116).

d. Thallus smooth; ultimate branches with unistratose wings
4. *R. Thaxteri* (p. 126).

c. Thallus slightly roughened throughout the greater part of its extent by low papillae, representing projections of surface-cells; ultimate branches with wings three cells thick
3. *R. Savatieri* (p. 124).

e. Thallus smooth; ultimate branches with unistratose wings
5. *R. crispa* (p. 131).

f. Thallus regularly pinnate, the branches narrower and usually shorter than the main axis, the majority being soon limited in their growth *g.*

f. Thallus irregularly pinnate, the branches usually narrower than the main axis but not infrequently showing indefinite growth *i.*

g. Surface-cells of axis more than half the width of the interior cells; ultimate branches flattened and usually with a wing three cells thick 6. *R. calva* (p. 134).

g. Surface-cells of axis less than half the width of the interior cells; ultimate branches often subterete and spine-like, never winged *h.*

h. Axis covered with a single layer of small cells, a broad median band of narrow cells being differentiated on the ventral surface 7. *R. Spegazziniana* (p. 137).

h. Axis covered with two layers of small cells throughout the greater part of its extent, the ventral surface-cells essentially like the others 8. *R. spectabilis* (p. 140).

i. Thallus with few or no latent branch-rudiments in the older part *j.*

i. Thallus with numerous latent branch-rudiments even in the older part *q.*

j. Axis soon becoming ascending or suberect, the plants forming loose tufts; ultimate branches without unistratose wings *k.*

j. Axis prostrate throughout the greater part of its extent, the plants forming depressed mats; ultimate branches often with unistratose wings two to five cells wide *p.*

k. Surface-cells of axis about half as wide as the interior cells or less; branches often tapering gradually to blunt points 9. *R. corralensis* (p. 143).

k. Surface-cells of axis more than half as wide as the interior cells; branches often narrow but rounded at the tips *l.*

l. Plants flaccid; axis mostly four to six cells thick in the median portion; dorsal surface-cells of axis usually 60-80 μ wide, the interior cells narrower 14. *R. conimitra* (p. 156).

l. Plants rigid; axis mostly eight to twelve cells thick in the median portion; interior cells not narrower than the dorsal surface-cells *m.*

m. Dorsal surface-cells of axis mostly 30-40 μ wide *n.*

m. Dorsal surface-cells of axis mostly 12-20 μ wide *o.*

n. Plants pale to bright green; main axis mostly 0.8-1 mm. wide and 0.3 mm. thick 10. *R. chilensis* (p. 145).

n. Plants pale to dark brown; main axis mostly 0.3-0.4 mm. wide and 0.2 mm. thick 12. *R. fuscobrunnea* (p. 152).

o. Thallus smooth throughout 11. *R. alcicornis* (p. 148).

o. Thallus roughened by crowded tooth-like or spine-like outgrowths 13. *R. spinulifera* (p. 154).

p. Thallus vaguely differentiated into axis, photosynthetic branches, and stolons; interior cells of axis averaging about 30 μ in width 15. *R. autoica* (p. 159).

p. Thallus undifferentiated; interior cells of axis averaging about 50 μ in width 16. *R. tenerrima* (p. 164).

q. Plants prostrate throughout the greater part of their extent or at least with a prostrate axis *r.*

q. Plants soon becoming ascending or suberect *w.*

r. Thallus copiously branched *s.*

r. Thallus sparingly branched *u.*

s. Branches often bounded by a unistratose wing two cells wide 17. *R. diversiflora* (p. 167).

s. Branches rounded to subacute at the sides in cross section but never winged *t.*

t. Thallus apparently prostrate throughout; axis and its branches with a median ventral band of narrow cells containing fungus hyphae 19. *R. mycophora* (p. 175).

t. Thallus with a prostrate axis and ascending to suberect branches; thallus destitute of specialized cells containing fungus hyphae 20. *R. nudimitra* (p. 177).

u. Thallus plane or nearly so on the upper surface 23. *R. pallidevirens* (p. 189).

u. Thallus with more or less involute margins, the upper surface thus becoming concave to canaliculate *v.*

v. Thallus covered over, especially on the ventral surface, with crowded tooth-like or band-like outgrowths, representing thickenings of the cell wall 24. *R. granulata* (p. 192).

v. Thallus smooth 25. *R. crassicrispa* (p. 194).

w. Latent branch-rudiments in the form of simple lobe-like projections, with the apical cell in the axil 22. *R. tenax* (p. 186).

w. Latent branch-rudiments in the form of low, bilobed projections, with the apical cell in the indentation between the lobes *x.*

x. Axis covered by a layer of cells about 14 μ wide, a gradual increase in width to the interior cells 30-45 μ wide being observable 18. *R. Negeri* (p. 172).

x. Axis covered by a layer of cells about 32 μ wide, an abrupt increase in width to the interior cells 75 μ wide being observable 21. *R. floribunda* (p. 182).

1. Riccardia fuegiensis Massal.

Riccardia fuegiensis Massal. Nuovo Gior. Bot. Ital. 17: 255. *pl. 26, f. 34.* 1885.
Pseudoneura fuegiensis Schiffn. & Gottsche in Schiffner, V., Forschungsreise "Gazelle" 4^4: 40. *pl. 8, f. 7-9.* 1890.
Pseudoneura lineolata Gottsche, *l. c.* (as synonym).
Aneura fuegiensis Evans, Contr. U. S. Nat. Herb. 1: 142. 1892.

Specimens examined: on humus, southern part of Smith Sound, near the entrance to the Straits of Magellan, 1883, *Görtner* (Y, specimen received from the Warnstorf Herbarium); without definite locality, Southern Patagonia, Voyage of the "Albatross" (U. S., listed by the writer as *Aneura fuegiensis*, **8**, p. 142); Lapotaia, 1896-97, *Hatcher* (Y., listed by the writer as *A. fuegien-*

sis, **9**, page 419, and **10**, p. 38); Eden Harbor, collector not named (M.); Cockle Cove, *Coppinger* (M.).

The following additional stations may be cited from the literature: Basket, Burnst and Staten Islands and Beagle Channel, *Spegazzini* (**16**, p. 256, including the type material); Otway Bay, Puerto Bono and Desolation Island, *Savatier* (**2**, p. 245) Tuesday Bay, *Naumann* (**19**, p. 40, as *Pseudoneura fuegiensis*); Newton Island, *Dusén* (**28**, p. 18, as *Aneura fuegiensis*); Hale and Atalaya Islands and Canal Inocentes, *Skottsberg* (**32**, p. 7, and **22**, p. 49, as *A. fuegiensis*).

There are few species of *Riccardia* that rival *R. fuegiensis* in size and complexity, and the thallus presents the unique feature of developing acropetal appendicular organs in the form of longitudinal lamellae on the ventral surface. These are described and figured not only by Massalongo but also by Goebel (**11**, p. 280, *f. 179*), who attributes to them the function of holding water by capillarity. Schiffner's figure (under *Pseudoneura*) may likewise be consulted. The color of the species varies from pale to dark brown, portions of the thallus sometimes becoming almost black. The plants are prostrate and either form loose depressed mats or else creep over the surface of other bryophytes. Neither rhizoids nor stolons have been observed.

The axis is clearly differentiated and grows indefinitely, the living portion being often 6-8 cm. long and occasionally as much as 12 cm. The width is mostly 1-1.5 mm. and the thickness 0.3-0.35 mm. In the axis a broad thickened median portion and unistratose wings can be distinguished, the change from the one to the other being fairly abrupt. The median portion is plane or nearly so dorsally and convex ventrally, the thickest part being mostly twelve to sixteen cells across. The cells of the superficial layer are small and almost isodiametric, averaging about $25 \times 22\ \mu$; their walls are somewhat thickened but pale. All the interior cells are elongated and average about $30\ \mu$ in diameter. The two or three layers just within the surface layer have strongly thickened and often pigmented walls, thus forming a fairly distinct sclerotic zone; this passes gradually into the central core, which is composed of cells with thinner and paler walls, but even here the walls parallel with the surface are usually distinctly thickened. The ventral lamellae are in about twelve rows on a well-developed axis. They vary in length but are mostly one to three cells wide; along the edge scattered or crowded teeth or cilia with blunt ends are present, each being mostly two to four cells long and one or two cells wide at the base. The cell walls of the lamellae are thickened, especially the bounding walls of the marginal teeth, but trigones are either absent or indistinct. The thallus-wings, which bear no ventral lamellae, are mostly five to seven cells wide and are more or less crispate, the margin being sinuate and also variously crenate, crenulate or denticulate. Trigones, which are sometimes confluent, are usually conspicuous, having convex sides. The bounding walls of the wing-cells are furthermore strongly and uniformly thickened, this feature being especially distinct along the margin.

The axis gives rise to two types of branches: slightly spreading branches with unlimited growth, which represent new axes and which are only occasionally produced; and obliquely spreading branches with limited growth, which represent the axes of photosynthetic branch-systems. Branches of the second type occur abundantly and arise at intervals of 1.5-3 mm. on each side of the axis. They show a tendency to be subopposite and are mostly 5-15 mm. long and 0.6-1 mm. wide. Each branch usually gives off on each side from six to ten crowded secondary branches, spreading obliquely and becoming successively shorter toward the apex of the primary branch. The upper secondary branches are simple but the others give off crowded tertiary branches and those toward the base may even show an occasional quaternary branch. The photosynthetic branch-systems formed by these crowded branches of various ranks are approximately ovate in outline and are often so close together that they overlap. The ultimate branches of whatever rank (and the tips of branches which are not ultimate) are mostly 0.3-0.4 mm. wide and are sometimes decurved. The median portion, which is still clearly set off from the wings, is only three cells thick and the rows of ventral lamellae are reduced to two. The wings are essentially like those of the axis, and the wings of a branch are continuous at the base with the wings of the higher axis, the only regular exception being at the base of the primary branches, where the main axis is wingless for a very short distance. Between the main axis and the ultimate branches are all possible intergradations.

The only specimens of *R. fuegiensis* seen by the writer are sterile or female. Male branches, however, are figured by both Massalongo and Schiffner, although neither author tells us anything about them in the text. According to Stephani the male branches are numerous and are borne on pinnae or pinnules, often terminating ultimate branches. He adds that they are small and hidden by branches under which they curve; that the wings are broad, erect and irregularly papulose; and that the antheridia may number as many as eight. The published figures support most of these statements but give no further information.

The female branches, in all the cases observed by the writer, are given off directly from the main axis and are usually in subopposite pairs. Before forming the female inflorescence, the branch usually gives rise to a secondary branch on the outer side and often to another on the inner side. The outer branch usually develops into a photosynthetic branch-system, somewhat less complex than those described above. The inner branch may give rise to a similar branch-system but is sometimes a second female branch, two closely approximated female branches being thus formed. In a single instance a proliferation of a primary female branch or perhaps a second outer branch was observed, consisting of a short thalloid structure with a single branch, both essentially like the ultimate branches of a photosynthetic system. The female inflorescence itself is very short and apparently develops very few archegonia. The involucre consists of a small number of crowded leaf-like or tooth-like lobes, the larger of which are shortly toothed. Underneath the inflorescence a few rudimentary lamellae may be demonstrated. The largest "calyptra" seen by the writer was 2.4 mm. long and 0.75 mm. wide, but Stephani gives the length as 5 mm. The surface is roughened by projecting cells or groups of cells, appearing (in Schiffner's words) as if it were covered over with angular particles of sand. The corona is distinct but small.

2. RICCARDIA PREHENSILIS (Hook f. & Tayl.) Massal.

Jungermannia (Metzgeria) prehensilis Hook. f. & Tayl. Jour. Bot. **3**: 480. 1844.

Metzgeria eriocaula var. *chilensis* G. L. & N. Syn. Hep. 505. 1846.

Metzgeria prehensilis Tayl. & Hook. f. in G. L. & N. Syn. Hep. 505. 1846.

Sarcomitrium prehensile Mitt. in Hooker, J. D., Fl. Novae Zealandiae **2**: 167. 1855.

Aneura prehensilis Mitt. in Hooker, J. D., Handb. New Zealand Fl. 543. 1867.
Acrostolia prehensilis Trevis. Mem. Ist. Lombardo III. **4**: 431 1877.
Riccardia prehensilis Massal. Nuovo Gior. Bot. Ital. **17**: 255 1885.
Riccardia eriocaula var. *chilensis* Besch. & Massal. Compt. Rend. Miss. Sci. Cap Horn **5**: 244. 1889.
Pseudoneura Lechleri Steph. in Bescherelle & Massalongo, *l. c.* (as synonym).
Pseudoneura prehensilis Schiffn. & Gottsche in Schiffner, V., Forschungsreise "Gazelle" **4**[4]: 41. *pl. 8, f. 12, 13*. 1890.
Pseudoneura marginata Gottsche, *l. c.* (as synonym).
Aneura Lechleri Steph. Hedwigia **32**: 26. 1893 (as synonym).
Aneura Lindaviana Steph. Sp. Hepat. **6**: 33. 1917.

Specimens examined: Hermite Island, *Hooker* (M., type of *Jungermannia prehensilis*); without definite locality, Chile, *Lechler 673* (N. Y., as *Metzgeria eriocaula* var. *minor* Hampe), Halt Bay, Straits of Magellan, *Cunningham 193* in part (M.); Staten Island, 1882, *Spegazzini 23* (M., see **16**, p. 255); Otway Bay, *Savatier 179s* (Massal., Y., as *R. eriocaula* var. *chilensis*, see **2**, p. 245); Villarina Bay, 1896-97, *Hatcher* (Y., listed by the writer as *Aneura prehensilis*, **9**, p. 410, and **10**, p. 38); without definite locality, southern Chile, *Reiche* (B., type of *Aneura Lindaviana*); Port Corral, 1905, *Thaxter 39, 98,* and specimen without number (H., Y).

In all probability *Riccardia prehensilis* is confined to the moist regions of southern South America. At one time it was supposed to occur also in New Zealand, but the old determinations upon which this opinion was based have since been proved incorrect. Later on Stephani reported its occurrence in Java (**27**, p. 664), basing his statement apparently on old specimens in the Mitten Herbarium. These specimens are labeled "Java" and clearly represent *R. prehensilis*, but it is doubtful if they really came from Java. At any rate Schiffner makes no mention of such a plant in his careful work on the Javan species of *Riccardia*, and neither *R. prehensilis* nor any closely allied species has lately been found on the island.

The following additional localities from Chile and Argentina may be cited from the literature: without definite locality, Chile, *Gay* (**13**, p. 505, and **18**, p. 299, as *Metzgeria eriocaula* var. *chilensis*); Port Famine, Straits of Magellan, *Andersson* (**1**, p. 13, as *Jungermannia prehensilis*); Mt. Sarmiento, Tierra del Fuego, and Basket Island, *Spegazzini* **16**, p. 255); Desolation Island, Wellington Island, Mère-le Dieu Island, and Isthmus Bay, *Savatier* (**2**, p. 245, as *R. eriocaula* var. *chilensis*); Tuesday Bay and Punta Arenas, *Naumann* (**19**, p. 41, as *Pseudoneura prehensilis*); Rio Aysen, Guaitecas Islands, and Puerto Blest, Lake Nahuelhuapi, Argentina, *Dusén* (**28**, p. 19, as *Aneura prehensilis*); Desolation Island, *Dusén* (**9**, p. 9, as *A. prehensilis*); Huafo, Atalaya and Hale Islands, Peel Inlet, Skyring, and Canal Jeronino, *Skottsberg* (**32**, p. 7, as *A. prehensilis*); Almirantazgo and Lake Fagnano, Tierra del Fuego, *Skottsberg* (**32**, p. 8, as *A. prehensilis*). It is probable that some of these records are based on the following species.

The plants of *R. prehensilis* are large and conspicuous and either creep over other bryophytes or grow in loose tufts. Their color is yellowish or brownish green, turning darker with age. Although the thallus lacks the remarkable lamellate outgrowths found in *R. fuegiensis,* it is almost as highly differentiated. The rigid main axis is prostrate or somewhat ascending at the apex and continues its growth indefinitely, the living portion being mostly 2-5 cm. in length. Its width is usually 0.5-0.9 mm. and its thickness 0.35-0.6. Although this indicates a certain amount of flattening, as the descriptions state, the edges of the axis are rounded in cross section and are never, so far as the writer's observations go, extended as wings, except sometimes in close proximity to the branches. The apical portion is crowded with slime-papillae, which excrete an unusually large volume of transparent mucus-like matter, sometimes faintly tinged with yellow.

The histological structure of the axis (Fig. 1, B) shows certain features in common with *R. fuegiensis* and other species of the genus in which the axis is robust and clearly differentiated. In well-developed plants it sometimes attains a thickness of thirty cells, the cells averaging about 20 μ in diameter. With the exception of two or three layers on the outside these cells are elongated and form a slightly flattened strand. Their walls are more or less thickened and supplied with pits. In the interior these walls are pale or almost colorless and only slightly thickened, the pits being relatively many; toward the outside they are pigmented with brown and strongly thickened, the pits being relatively few. The pigmented zone is connected by a gradual transition with the pale interior portion; it is usually from five to eight cells thick and is especially distinct ventrally. The cells outside the pigmented zone are only slightly longer than broad. Those of the superficial layer are the most distinctive, each one projecting as a short and rounded, hyaline, thin-walled papilla. The basal portions of these cells have slightly thicker walls, and the same thing is true of the one or two layers between the surface-layer and the pigmented zone. The surface-layer with its crowded thin-walled papillae extends not only over the axis but over the branches throughout the greater part of their extent. It constitutes one of the most striking peculiarities of the species and gives the whole surface a velvety appearance under the lens.

At fairly regular intervals of 1-3 cm. the axis gives rise to closely pinnate or bipinnate, obliquely spreading branch-systems (FIG. 1, A), broadly ovate in outline and often contiguous. These branch-systems, which are photosynthetic in character, are subopposite and soon limited in their growth, attaining a length of 5-10 mm. Toward their apices the branches are often decurved, loosely grasping objects with which they are in contact and thus justifying the specific name *prehensilis*. This feature is well shown in the Flora Antarctica figure (34, *pl. 160, f. 9*). The primary branches of these photosynthetic systems are strongly flattened, mostly 0.5-0.7 mm. wide and 0.2-0.3 mm. thick. They are winged throughout, except sometimes in the basal portion, and the wings may even be decurrent for a short distance on the main axis. The ultimate branches (FIG. 1, C) are similar to the primary branches but are only 0.25-0.5 mm. in width. Their wings are distinct, each wing occupying about one third the width of the branch. Except at the very edge the wings are three cells thick, the middle layer being composed of short cells with slightly thickened walls and the surface layers, both above and below, showing their characteristic, thin-walled, papillate projections (FIG. 1, D, E). In typical cases these extend forward and slightly overlap each other, but they may be too short to do this. The surface-cells average about 20 μ in width. At their margins the wings are denticulate or crenulate, being bounded by a single row of hyaline, projecting

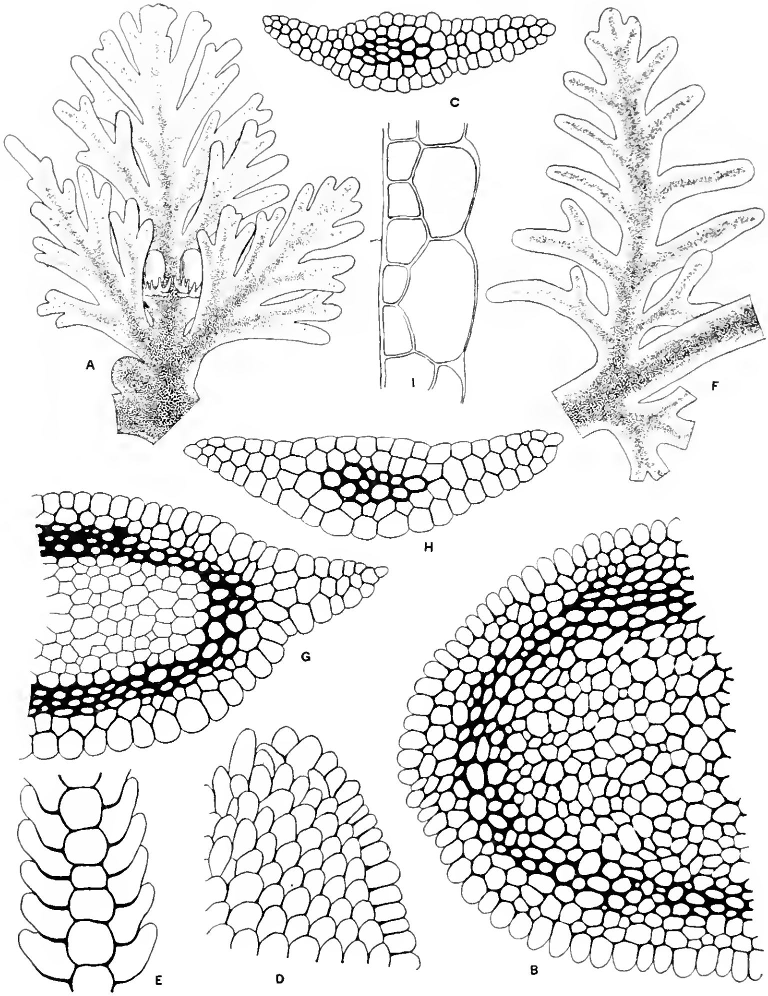

FIGURE 1

A-E. RICCARDIA PREHENSILIS (Hook. f. & Tayl.) Massal.

A. Photosynthetic branch-system with two female branches, growing point of main axis at left, x 8. B. Transverse section of axis, x 100. C. Transverse section of ultimate branch, x 100. D. Surface of ultimate branch near apex, x 225. E. Longitudinal section of ultimate branch near margin, x 225. The figures were all drawn from a specimen without number collected at Corral by R. Thaxter.

F-I. RICCARDIA SAVATIERI (Steph.) Evans

F. Photosynthetic branch-system, x 8. G. Transverse section of axis, x 100. H. Transverse section of ultimate branch, x 100. I. Cells of two outer layers of ultimate branch in longitudinal section, x 300. H was drawn from a specimen collected at Halt Bay by A. Cunningham, No. 183; G-I, from a specimen collected by A. E. Douglas at Grappler Bay.

cells. The median portions of the ultimate branches are six or seven cells thick. The central part is occupied by two or three layers of thick-walled cells, forming a narrow strand and covered over, both above and below, by layers of cells similar to the wing-cells. In the primary branches the structure is much the same as that just described, but the central strand of the median portion is thicker and the wings may be four cells thick in places.

In rare instances a branch is formed which represents a new axis. It takes its origin between two photosynthetic systems, diverging but slightly in direction from the main axis, and eventually gives rise to a separate individual. Another type of branch which is more frequent and yet only sparingly produced is the stolon. A branch of this character occupies the same position as a new axis and is sometimes so close to the lower of two photosynthetic systems that it seems to be axillary in origin. A stolon soon grows downward and may attain a length of 5 mm. or more, a width of 0.35 mm. and a thickness of 0.25 mm. It is sparingly and irregularly branched and shows a structure similar to that of the main axis, except that the zone of thick-walled pigmented cells is thinner and less well defined.

The inflorescence of *R. prehensilis* is dioicous. The male branches usually arise as the secondary branches of a primary photosynthetic axis. In typical cases an axis of this character first bears a few vegetative branches, then from three to six pairs of male branches, and then a few more vegetative branches before the growth of the system is brought to an end. This typical condition, however, is not always realized, and a male branch may even be borne on a secondary photosynthetic axis, thus representing a tertiary branch. The male branches are simple and are almost wholly occupied by the terminal inflorescences, sterile proliferations being exceedingly rare. Instead of spreading widely the male branches scarcely spread at all, being often partially concealed beneath the wings of the primary branch. The inflorescences are laterally compressed and are usually 0.9-1.4 mm. long and 0.3-0.45 mm. wide. The marginal wings, which are erect or connivent, are two or three cells wide and distinctly crenulate or denticulate from projecting cells. The antheridia are mostly eight to sixteen, in two longitudinal rows, and the openings of the antheridial chambers are usually separated from one another by two rows of slightly projecting cells, giving a rough appearance to the upper surface of the inflorescence.

The female branches (FIG. 1, A) are usually borne in a single pair on the main axis of a photosynthetic branch-system. This axis first gives rise to two vegetative branches, then to the two female branches, and then to a considerable number of vegetative branches. Occasionally there are deviations from this arrangement. There may, for example, be more than two female branches, or the female branch may represent the first secondary branch of the system instead of the second. The female branches are short and usually limited in growth after producing from one to four archegonia; in very rare cases the branch may continue its growth beyond the archegonia as a short and sterile extension. The involucre, which may be understood to include the wings of the female branch, consists of crowded and slender teeth or cilia, sometimes eight or ten cells long. The large and massive "calyptra" is, when mature, 3.5-4 mm. long and 0.9 mm. wide. At its apex it bears a distinct corona, and its surface is otherwise roughened by cells which are peeling off. Unfortunately no sporophytes in good condition have been available for study.

The close relationship which exists between *R. prehensilis* and the New Zealand *R. eriocaula* (Hook.) Besch. & Massal. has been brought out again and again. Schiffner (19, p. 41) goes so far as to imply that they may be synonymous and calls attention to the fact that Leitgeb's account of *R. eriocaula* (15, p. 49) would apply equally well to *R. prehensilis*.. As a matter of fact the two species do resemble each other very strikingly. They have much the same habit, they do not differ markedly in size, and they are both covered over with surface-papillae. If their vegetative parts are carefully compared, however, important distinctions at once become apparent. Their surface-papillae, for example, are different in structure. In *R. prehensilis*, as we have seen, the papillae represent projections of the surface-cells, but in *R. eriocaula* they represent distinct cells, being cut off from the cells of the superficial layer by walls. This difference is seen with especial clearness when the ultimate branches of photosynthetic systems are compared. In *R. prehensilis* the wings are three cells thick, being covered over by a continuous layer of papillate cells; in *R. eriocaula*, on the other hand, the wings in the outer part are only one cell thick, and the papillae are scattered, not only here but over the thickened median portion of the branches. In this species, moreover, the ultimate branches are only 1-1.5 mm. wide. A few differences in the male plants may likewise be noted. In *R. eriocaula* the male branches are less definite in position than in *R. prehensilis*. Although they often represent the secondary branches of a primary photosynthetic axis they are just as likely to represent tertiary branches, in which case they take their origin at the base of secondary branches. The inflorescence itself is relatively short and strongly curved downward. Its connivent wings, which are composed of large hyaline cells, are unusually wide, being often six to eight cells across. The margins of the wings, in typical cases, show a series of low rounded lobes and an occasional cell may project as a short tooth. In some cases the marginal cells are narrow and elongated in the direction of the edge, but this feature is far from constant. Many of the distinctive characters of *R. eriocaula* are clearly brought out in Stephani's description (**27**, p. 671).

According to the Synopsis Hepaticarum the var. *chilensis* of *R. eriocaula* is erect and has broader ultimate branches than the typical form of the species, being intermediate between the true *R. eriocaula* and *Aneura fucoides*. Except for the erect habit these scanty details and the fuller description given by Montagne (**18**, p. 298) point to *R. prehensilis*, but unfortunately the type specimen of the variety has not been available for study. In the writer's opinion, however, a specimen collected at Otway Bay by Savatier and referred by Bescherelle and Massalongo to the var. *chilensis* is clearly *R. prehensilis* and is listed above under that name. This opinion supports the statement made by Schiffner regarding Savatier's specimens (see page 99). It therefore seems justifiable to list his other specimens of var. *chilensis* under *R. prehensilis* and to reduce the variety to synonymy, at least provisionally.

Stephani's *Aneura Lindaviana* was based on a specimen collected by Reiche in southern Chile and communicated by Lindau. According to the description it is distinguished by a robust and subterete axis, covered over whith crowded setulae, and by smooth wingless branches. The type specimen in the Boissier Herbarium, however, shows that the species is a synonym of *R. prehensilis*. The branches, instead of being smooth and wingless, show the appressed papillae and the wings three cells thick which are characteristic of the older species; and the male branches present, which Stephani does not mention in his description, are likewise unmistakable.

3. **Riccardia Savatieri** (Steph.) comb. nov.

Aneura Savatieri Steph. Hedwigia **32**: 26. 1893.

SPECIMENS EXAMINED: York Bay, Straits of Magellan, *Lechler* (M.); Grappler Bay, Straits of Magellan, 1893 *A. E. Douglas* (H., Y.); Rio Azopardo, Tierra del Fuego, 1896, *Dusén 76* (N. Y., as *Aneura Savatieri,* apparently listed by Stephani as *A. prehensilis,* see **29**, p. 9).

The following records for *R. prehensilis,* cited by Bescherelle and Massalongo (**2**, p. 244), should probably be transferred to *R. Savatieri:* Mère-le Dieu, Wellington, Clarence and Hoste Islands, Otway Bay and Isthmus Bay, *Savatier.*

In general habit and color *R. Savatieri* resembles *R. prehensilis* in a marked degree. The prostrate axis is even more rigid and robust, however, and attains a length of 5-10 cm., or even of 15 cm. according to Stephani's description. This axis, which exhibits a long-continued growth, is flattened and distinctly winged throughout its entire length. It shows a width of 0.9-1.1 mm. and a thickness of 0.3-0.4 mm. in the median portion. Its structure is much the same as in *R. prehensilis.* In the median portion, where it is about twenty cells thick (FIG. 1, G), it shows a flattened central strand of elongated cells. The interior cells of the strand have thin and unpigmented walls but an exterior zone, one to three cells thick, is composed of cells with thickened and usually pigmented walls, the color varying from yellow to light or dark brown. Outside this zone there are usually two layers of short cells or, in places, three layers. The cells of the superficial layer show thickenings at their angles in surface-view and project very slightly as rounded papillae (see FIG. 1, I). Their walls are otherwise only vaguely thickened and the same thing is true of the cells between this layer and the thick-walled zone of the central strand. In spite of their differentiation the cells do not vary greatly in size, when seen in cross section, the average diameter being about 20 μ, but the surface-cells are often 25-30 μ wide. On the sides the axis thins out rather abruptly into the wings, which are three cells thick throughout most of their extent. The surface-cells are like those of the median portion, but the trigones at the upper end are more likely to be coalescent and to take part in the formation of the low papillae which the cells develop. The inner layer of the wing is composed of short cells and represents a continuation of the short-celled second layer of the median portion. Along the edges the wings are bordered by a distinctly differentiated row of hyaline cells, projecting slightly as crenulations.

At intervals of 1.5-3 cm. the axis gives rise to photosynthetic branch-systems (FIG. 1, F), just as in *R. prehensilis*. The branch-systems are often approximated in pairs but not invariably so, and are soon limited in growth, attaining a length of 5-10 mm. Each system is narrowly ovate in outline; it consists of a distinct primary axis bearing at close intervals a series of secondary branches. These decrease gradually in length and are usually simple, but in some cases one or two of the secondary branches on each side will form one or two very short tertiary branches. On the whole the photosynthetic branch-systems are less complex than those of *R. prehensilis* and apparently show no tendency to be decurved toward their extremities. Neither stolons nor new axial branches have as yet been observed.

The primary branches of a photosynthetic branch-system are mostly 0.75-0.9 mm. wide, while the secondary branches are only 0.4-0.6 mm. wide. All the branches show distinct wings, which are continuous with one another and also with the wings of the main axis. In the ultimate branches (FIG. 1, H) each wing is about one third the width of the branch and is essentially like the wings of the main axis. The cells, however, are a little larger than those of the median portion of the axis, the surface-cells measuring about $40 \times 25\ \mu$ and the interior about $30 \times 25\ \mu$. The interior of an ultimate branch, just as in *R. prehensilis,* is occupied by a narrow band of thick-walled cells. Although the projecting surface-cells, both on the wings and elsewhere, tend to give the plants a velvety appearance, this is often scarcely apparent, owing to the slight projection of the papillae (FIG. 1, I). In some cases, in fact, the cells scarcely project at all.

The inflorescence of *R. Savatieri* is dioicous, but the material at the disposal of the writer is so incomplete that only one plant of each sex has been available for study. In the male plant the sexual branches occurred in pairs and represented the basal secondary branches of short photosynthetic systems. The inflorescences averaged about 0.6 mm. in length and 0.35 mm. in width and were less compressed than those of *R. prehensilis,* the narrow wings being suberect but scarcely connivent. In the female plant the sexual branches occupied the same position as the male branches and showed no signs of growing beyond the archegonia. Unfortunately the two involucres observed were so disintegrated that their structure could not be made out; the "calyptras" were immature, but one showed a distinct corona. It will be remembered that Stephani's description of *Aneura Savatieri* was drawn wholly from sterile material.

It is not surprising that *R. prehensilis* and *R. Savatieri* have been confused. They agree with each other not only in general appearance and habit but also in certain important structural features, such as the surface layer of papillose cells, the three-layered wings of the branches, and the row of hyaline cells bordering the wings. At the same time they can be clearly distinguished by means of their vegetative characters alone. The most important of the differential peculiarities are perhaps the following, some of which have already been indicated in the foregoing description: in *R. prehensilis* the axis is wingless or essentially so, the superficial cells of the axis and its branches average about 20 μ and project as distinct and often overlapping papillae with thin walls, and the photosynthetic branch-systems are copiously branched and broadly ovate in outline; in *R. Savatieri,* on the other hand, the axis is winged throughout, the superficial cells measure about 25 μ in width and project very slightly as indistinct and often thick-walled papillae, while the photosynthetic branch-systems are less copiously branched and narrowly ovate in outline. In all probability Bescherelle and Massalongo separated the species clearly but referred *R. Savatieri* to *R. prehensilis* and the true *R. prehensilis* to *R. eriocaula* var. *chilensis* (see page 123).

4. **Riccardia Thaxteri** sp. nov.

Growing in intricate mats, brownish green varying to almost black: thallus ascending to suberect from a prostrate basal portion, the axis subterete and wingless below, flattened and often winged above, the prostrate portion giving off a few subterete stolons and an occasional new axis, the ascending portion closely pinnate to tripinnate, a complex photosynthetic branch-system being thus formed: ultimate branches strongly flattened, with unistratose wings three or four cells wide and a thickened median portion, the wings sometimes crenulate or denticulate from projecting cells, composed of cells with small but distinct trigones: inflorescence dioicous: ♂ inflorescences sometimes borne singly but usually in divaricate clusters of two to eight, the wings vaguely toothed, one or two cells wide, the antheridia mostly six to ten: ♀ inflorescence usually borne at the base of a more or less elongated and often subdivided branch; involucre composed of crowded teeth or cilia; calyptra rough, tipped with a distinct corona: sporophyte unknown.

Specimens examined: on rotten wood, Port Corral, 1905-06, *Thaxter 133* (H., Y.). Known only from the type locality. The writer takes pleasure in naming this distinct species in honor of its discoverer, Professor Roland Thaxter of Harvard University.

Although less robust than the species already considered *R. Thaxteri* is a relatively large plant and exhibits considerable differentiation. The plants are very dark in the old prostrate portions but are yellowish or brownish green when young and tend to remain so in the photosynthetic branches. Owing to the method of branching, about to be described, the thalli remain united in loose but intricate tufts, closely attached at their bases to the substratum. In each thallus (Fig. 2, A) a prostrate or decumbent basal portion and an ascending or suberect apical portion can be distinguished, although there is no sharp line between them. The basal portion is essentially a rhizome and consists of a sparingly branched axis, which is terete or nearly so. The branches to which it gives rise are of two kinds: those which represent the axes of new thalli, and those which may be regarded as stolons. The latter are usually simple and soon limited in their growth; they cling closely to the substratum emitting numerous rhizoids. All the branches given off from the prostrate axis arise from latent rudiments in the form of blunt and often scarcely evident projections, covered over with slime papillae, and some of these rudiments fail to develop into branches. The figure will give some idea of the way in which the prostrate axis branches.

The apical portion of a thallus (Fig. 2, A, B) is essentially a flat photosynthetic branch-system. The subterete basal portion grad-

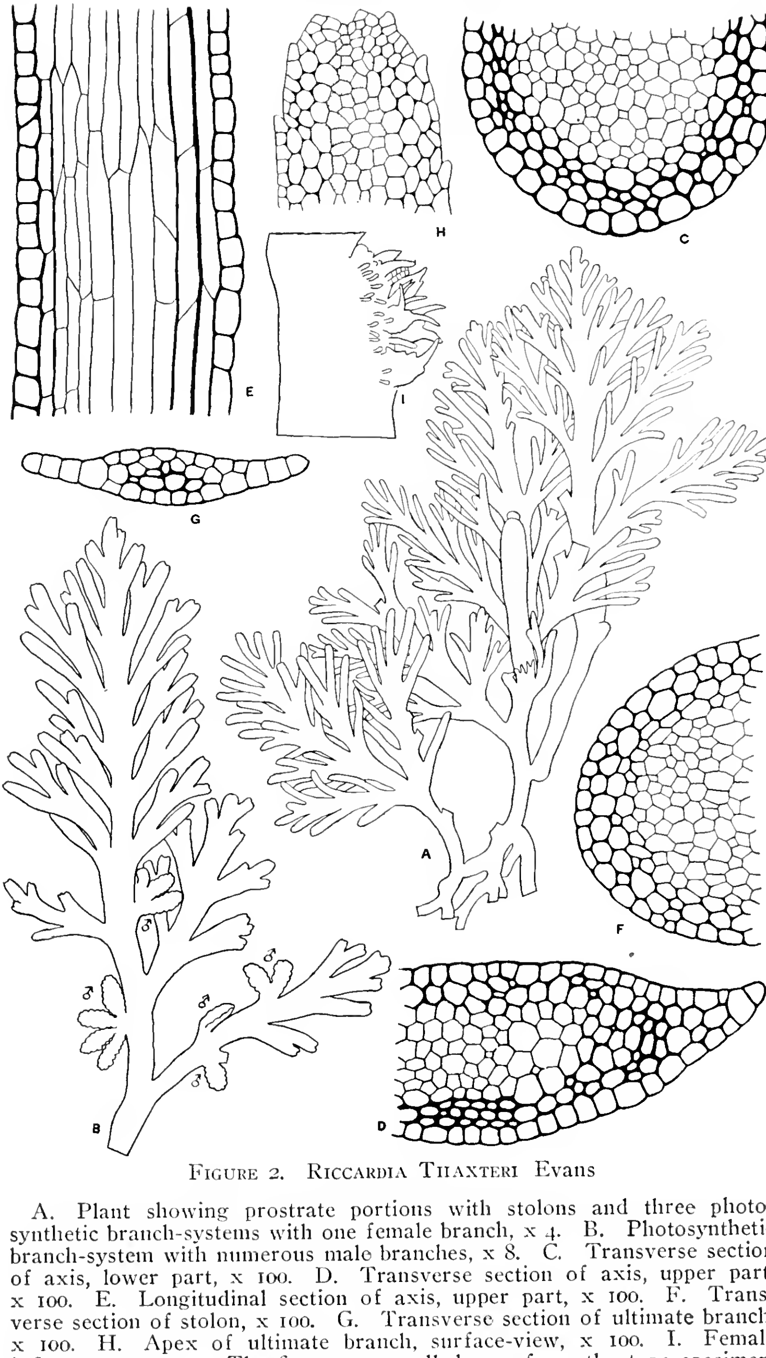

FIGURE 2. RICCARDIA THAXTERI Evans

A. Plant showing prostrate portions with stolons and three photosynthetic branch-systems with one female branch, x 4. B. Photosynthetic branch-system with numerous male branches, x 8. C. Transverse section of axis, lower part, x 100. D. Transverse section of axis, upper part, x 100. E. Longitudinal section of axis, upper part, x 100. F. Transverse section of stolon, x 100. G. Transverse section of ultimate branch, x 100. H. Apex of ultimate branch, surface-view, x 100. I. Female inflorescence, x 40. The figures were all drawn from the type specimen.

ually curves away from the substratum, becomes broader and more and more flattened, and soon gives rise to a crowded series of flattened branches, gradually decreasing in length toward the apex of the main thallus, the latter becoming narrower and narrower and soon being limited in growth. In typical cases the lower branches of the system thus formed are pinnate or even bipinnate to a slight extent, the secondary branches being crowded and exhibiting in their turn a gradual decrease in length. As the apex of the system is approached the primary branches, with their decrease in length, give off fewer and fewer secondary branches, and the primary branches in the vicinity of the apex are quite undivided. When well developed a photosynthetic branch-system is broadly ovate in outline, 1-1.5 cm. long and 0.75-1 cm. wide, the prostrate portion of the thallus being somewhat shorter. The main axis in its basal part is mostly 0.6-0.7 mm. in diameter, becoming perhaps 1 mm. wide above, and the ultimate photosynthetic branches are mostly 0.2-0.3 mm. wide. It will be noted that the photosynthetic branch-systems of *R. Thaxteri* are terminal structures involving the main axes of thalli; in *R. fuegiensis, R. prehensilis* and *R. Savatieri* the photosynthetic systems are lateral, and the main axis of a thallus continues its growth indefinitely.

The histological features of *R. Thaxteri* may now be considered. In the basal portion (FIG. 2, C) the thallus is about twenty cells thick and is bounded by a single layer of short cells about 30 μ wide. These cells have slightly thickened walls and are flat on the outside. The interior is made up entirely of elongated cells. A zone two or three cells thick, just within the surface layer, is composed of cells with more strongly thickened and usually pigmented walls; the remainder is made up of cells with thin and colorless walls. These cells vary but little in diameter although the cells of the thick-walled zone are a trifle smaller than those of the outside layer. In its widest part (FIG. 2, D) the main axis is perhaps thirty-five cells wide and twelve cells thick. In this region it is narrowly fusiform in section, thinning out gradually on the sides and often bounded by a very narrow wing one cell thick and one or two cells wide. The elongated thick-walled cells (FIG. 2, F) are less pronounced than in the basal portion and often form an interrupted zone, more marked ventrally than dorsally; otherwise the structure is very similar. The ultimate photosynthetic branches are strongly flattened and show distinct wings three or four cells wide and one cell thick (Fig. 2, G, H). The median portion is about as wide as the wings and four or five cells thick. The interior cells are elongated and thick-walled, forming a narrow band or strand; the surface-cells of the median portion are short, mostly 25 μ wide, and scarcely show trigones. The cells of the wings are slightly wider but gradually decrease in width toward the margin, the cells next to the median portion measuring about 40 μ in width, those of the second row 37 μ, those of the third row 34 μ, and those of the marginal row 20-30 μ. The wing-cells have distinct trigones, and scattered cells along the margin sometimes project as blunt or subacute teeth. Between the ultimate branches and the flattened main axis are all possible gradations. The stolons (Fig. 2, F) show a structure which is essentially like that of the prostrate axis, except that the zone of thick-walled elongated cells is very indistinctly defined.

The male plants observed (see Fig. 2, B) are rather more slender than the female, but it is doubtful if this difference is at all constant. The male branches arise in the basal portion of a photosynthetic branch-system, sometimes representing primary branches and sometimes secondary branches of one of the lowest photosynthetic branches. In some cases a male branch is tipped immediately by an inflorescence, but it usually subdivides almost at once into from two to eight branches, each tipped by an inflorescence, the whole forming a divaricate cluster. The individual inflorescences, which apparently never proliferate, are mostly 0.6-0.9 mm. long and 03.-0.35 mm. wide. The antheridia are mostly six to ten in number, and the openings into the antheridial chambers are usually separated by two rows of cells. The narrow marginal wing, usually two cells wide, spreads slightly and is vaguely and irregularly crenulate from projecting cells.

The female branches (Fig. 2, A), rarely as many as four on a thallus, are borne in the lower part of a photosynthetic branch-system and represent either primary branches or the basal branches of secondary branches, agreeing in these respects with the male branches. The inflorescence is borne close to the base of the branch, which usually continues its growth beyond the archegonia, sometimes forming a simple strap-shaped extension but usually giving rise to secondary or even tertiary branches, very much as a photosynthetic branch might do. The involucre (FIG. 2, I) consists of crowded teeth or cilia, mostly three to eight cells long, and the archegonia are usually four or fewer. The "calyptra" when mature measures 5 mm. or more in length and 0.9 mm. in diameter. At the tip a distinct corona is developed, and the rest of the surface is roughened by cells which are being thrown off. The sporophytic characters are still unknown.

There is little in common between *R. Thaxteri* and the other Chilean species of *Riccardia*. Although rivalling the three preceding species in complexity it is at once distinguished from *R. fuegiensis* by its total lack of dentate lamellae and from the other two by its perfectly smooth surface, the bounding walls of the outside layer being flat or nearly so. In fact the thallus is wholly destitute of appendicular organs except for the slime papillae, the rhizoids and the minute dentations or crenulations of the wings.

5. **Riccardia crispa** (Schiffn. & Gottsche) comb. nov.

Pseudoneura crispa Schiffn. & Gottsche in Schiffner, V., Forschungsreise "Gazelle" **4**[4]: 41. *pl. 8, 14, 15.* 1890.

Aneura umbrosa Schiffn. & Gottsche, *op. cit.* 42. *pl. 8, f. 10, 11.* 1890.

Aneura crispa Steph. Hedwigia **32**: 137. 1893.

Aneura endiviaefolia Goebel, Organographie, 279. *f. 176.* 1898.

SPECIMENS EXAMINED: Tuesday Bay, Straits of Magellan, 1876, *Naumann* (S., Y., type of *Pseudoneura crispa*, and S, type of *Aneura umbrosa*); without definite locality, Tierra del Fuego, 1896-97, *Hatcher* (**9**, p. 410); Puerto Angusto, Desolation Island, 1896, *Dusén 151* (N. Y., as *A. endiviaefolia*); Island Harbor, 1868, *Cunningham* (M.); Port Gallant, *Lechler* (M.); southern Chile, *Spencer* (M.); Otway Harbor, Gulf of Penas, Challenger Expedition (M., as *A. polyclada*); Albert Bay, *Coppinger* (M.).

The following additional records in the literature for *A. crispa* may be cited: Newton and Guaitecas Islands and Molineux Sound, *Dusén* (**28**, p. 18); Clarence Island, *Racovitza* (**30**, p. 4); Huafo, Guaitecas, Hale and Atalaya Islands, Canal Inocentes and Canal Jeronimo, *Skottsberg* (**32**, p. 6, 7, and **22**, p. 36, 38, etc.).

It is difficult to determine the habit of this distinctive species from the material available. It presents every appearance, however, of being a prostrate plant, forming loose depressed mats or creeping over other bryophytes without being closely adherent to the substratum. Its color is yellowish or brownish, becoming darker with age; and the vegetative thallus, which is the only part studied by the writer, exhibits considerable differentiation. The main axis continues its growth indefinitely, the living portion being usually 1-3 cm. long, although according to Schiffner and Stephani the plants are sometimes 5 cm. long. When well developed it measures 0.7-1 mm. in width and about 0.3 mm. in thickness, the median portion being from ten to twelve cells thick. From this thickened region it thins out gradually toward the edges but does not form wings, the cross section appearing biconvex and acutely pointed.

The histological features differ in several important respects from those of the preceding species, although a central core of elongated cells is still present, surrounded by an outside layer of short cells. The latter, however, which measure about 20 μ in diameter, are thin-walled and distinctly smaller than the interior cells, which average about 30 μ just within the surface layer and 40 μ in the central portion of the axis. The elongated cells have slightly thickened walls but give no indication of an external zone with their walls strongly thickened and pigmented. On the whole the cell-differentiation of the axis is slight, agreeing in this respect with the majority of the species.

On each side the axis gives off complicated photosynthetic branch-systems, sometimes only 0.5 mm. apart and sometimes more distant. The axis of such a system, beginning at the base, gives rise to closely crowded secondary branches and these in turn to tertiary branches, the branches tending to decrease in length as the apical portion of the system is approached. When well developed the system has the appearance of an ovate mass 0.5-1 cm. long, composed of overlapping and interwoven, strap-shaped and often variously crispate or contorted branches. The systems are often so close together that they touch.

The ultimate branches yield some of the most important characters of the species. They are clearly differentiated into a narrow median portion, three cells thick and only two cells wide, and two broad wings, one cell thick and three or four cells wide. The cells of the wings are hyaline and average about 45 x 35 μ, those along the margin projecting as distinct crenulations. The cells of the median portion are longer and narrower than the wing-cells, measuring about 60 x 30 μ. The ultimate or tertiary branches measure 0.15-0.2 mm. in width, the secondary branches 0.2-0.3 mm., and the primary branches 0.3-0.45 mm. The wings, which form so marked a feature of the ultimate branches, are narrower and less distinct on the secondary branches and still narrower on the primary branches, tending to disappear altogether before the main axis is reached.

Photosynthetic branch-systems of the complexity just described are not always developed and are to be expected only at some little distance from the apex of the main axis. As this apex is approached the systems become simpler and simpler, merely because they are younger and have not yet had time to develop. The branches in the vicinity of the apex, in fact, are so simple that they give no indication of the intricate systems into which they will presumably develop. Sometimes, if conditions are unfavorable, the branch-systems remain relatively undeveloped and give rise to plants which seem very different from typical specimens. It was apparently upon plants of this sort that *Aneura umbrosa* was based, and the writer agrees with Stephani (**27**, p. 684) in regarding this species as a juvenile form of *Riccardia crispa*. According to Schiffner *Aneura umbrosa* is characterized by a thallus-margin which is neither pellucid nor composed of a single layer of cells. This description certainly applies to the axis and to most of the branches of the fragmentary type specimen, but would apply just as well to the apical portion of the thallus in typical *R. crispa*. A few of the ultimate branches in *A. umbrosa*, moreover, show a unistratose wing three cells wide and a thickened median region, thus justifying still further the reduction of the species to synonymy.

In his study of *R. crispa* the writer has seen neither stolons nor rhizoids, and the earlier descriptions make no mention of such structures. According to Stephani the main axis is simple or repeatedly forked in the upper part and Schiffner's figure shows an axis with a single fork. Although no forking axes have been observed in the present study, this is doubtless due to the small amount of available material. It may be noted that Schiffner's figure shows a thallus in which the photosynthetic systems are rather sparingly branched, and the type material of the species is of the same nature. His figure of an ultimate branch, however, shows the wings clearly and his figure of an axial cross section in *Aneura umbrosa* is equally distinctive.

The name "*Aneura endiviaefolia*" was given by Stephani to specimens from Desolation Island collected by Dusén, and a specimen so named is in the herbarium of the New York Botanical Garden. In his published account of Dusén's collection (**29**) this name does not appear, but *A. crispa* is listed from the island in question. In all probability Stephani recognized the fact that *A. endiviaefolia* was a synonym of *A. crispa* and therefore made no formal mention of his species. Meanwhile Goebel (**11**, p. 279, *f. 176*) had published an excellent figure of *A. endiviaefolia* with a brief description of the thallus. Unfortunately he gave no authority for the name; neither did he tell us where his material came from. His figure represents the apical portion of a vigorous thallus and, taken in conjunction with his description, shows pretty clearly that it was drawn from *A. crispa*. The writer therefore feels justified in assuming that Goebel's *A. endiviaefolia* was the same as Stephani's and that Goebel's figure was drawn from Dusén's material.

6. **Riccardia calva** (Schiffn. & Gottsche) comb. nov.

Aneura calva Schiffn. & Gottsche in Schiffner, V., Forschungsreise "Gazelle" **4**[4]: 42. *pl. 8, f. 16.* 1890.

Specimens examined: Tuesday Bay, Straits of Magellan, 1876, *Naumann* (S., Y., type of *Aneura calva*). Known only from the type locality. The specimen collected by Hatcher on Tierra del Fuego and cited under *A. calva* by the writer (**9**, p. 410, and **10**, p. 38) is now referred to *Riccardia spectabilis*.

At first sight *R. calva* looks as if it might be a small form of *R. Savatieri*, but a careful comparison brings out numerous distinctive features. It is quite impossible to determine the general habit of the species from the specimens examined. In all probability the thalli are prostrate; at the same time neither rhizoids nor distinct stolens have been observed, so that the plants can not be closely adherent to the substratum. They apparently occur in loose tufts without much admixture and are brown or yellowish brown in color, becoming darker with age.

The main axis is rigid and exhibits indefinite or at least long-continued growth; it is usually 2-4 cm. long, 0.6-0.8 mm. wide and 0.3-0.35 mm. thick. These measurements signify a certain amount of flattening and the cross section (FIG. 3, A) shows a biconvex outline, more strongly bulging below than above and tapering out gradually on each side to a blunt point. The axis is bounded by narrow and indistinct wings three or four cells thick and covered over both above and below by five or six rows of surface-cells averaging about 30 x 20 μ; no row of marginal cells is differentiated. The median portion of the axis is usually twelve to fourteen cells thick, the cells (with the exception of the surface-cells) averaging about 30 μ in diameter. The surface layer and the layer just inside, which is continued into the wings, are composed of relatively thin-walled cells. They are succeeded by one or two layers in which the walls are thickened and often pigmented, but the sclerotic zone thus indicated is far less distinct than in *R. Savatieri*; toward the upper surface it is usually clear enough but tends to be indefinite both ventrally and laterally. The interior is made up wholly of cells with pale and scarcely thickened walls. With the exception of the wing-cells and the two outermost layers of the median portion, the cells of the axis are more or less elongated.

At intervals of 1-2 mm. the axis gives rise on each side to obliquely spreading branches, quickly limited in their growth and measuring 2-5 mm. in length by 0.4-0.6 mm. in width. Each primary branch usually bears on each side from one to three secondary branches, the latter being mostly alternate, 0.4-0.8 mm. long and 0.2-0.3 mm. wide. When more than one secondary branch is present on a side they are distant and a gradual decrease in length is apparent. The photosynthetic systems thus formed are simpler than in *R. Savatieri* and other allied species and show a lanceolate or narrowly ovate outline. The secondary branches in their most characteristic development (FIG. 3, B) are more strongly flattened than the axis and primary branches, the median portion being only seven or eight cells thick. The wings are about as wide as the median portion and tend to be more clearly defined than in the broader parts of the thallus. They are mostly three cells thick throughout (as described by Stephani) but may be four cells thick next the median portion and only two cells thick toward the edge. At the very edge an interrupted row of marginal cells

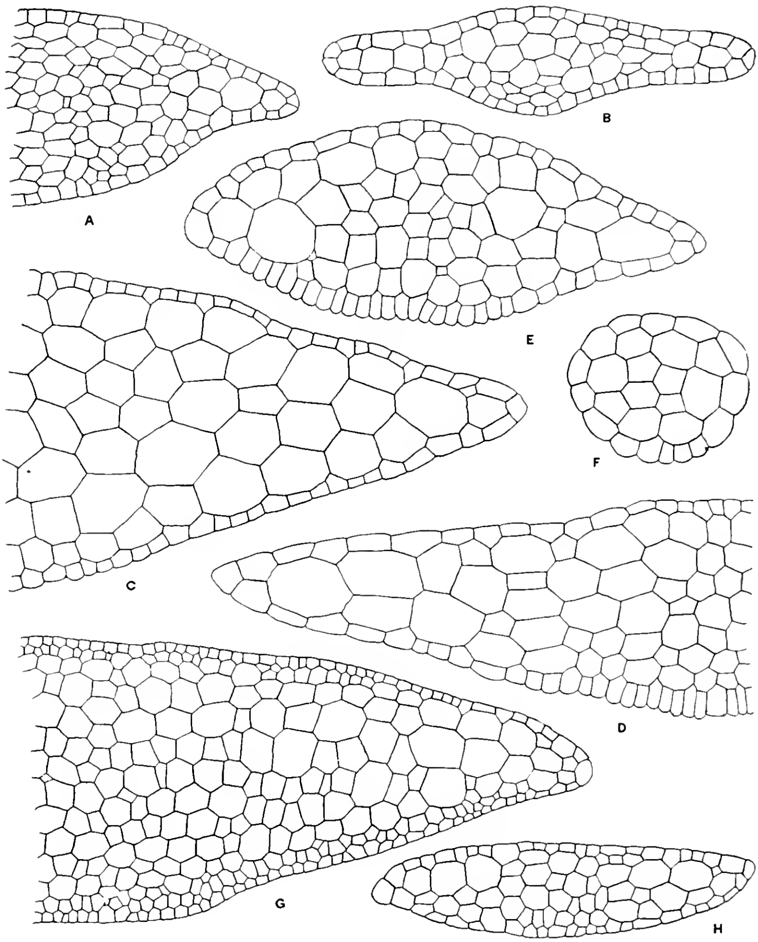

FIGURE 3

A, B. RICCARDIA CALVA (Schiffn. & Gottsche) Evans

A. Transverse section of axis, x 100. B. Transverse section of ultimate branch, x 100. The figures were both drawn from the type material of *Aneura calva.*

C-F. RICCARDIA SPEGAZZINIANA Massal.

C. Transverse section of axis, x 100. D. Transverse section of wide primary branch, x 100. E. Transverse section of narrow primary branch, x 100. F. Transverse section of terete branch, x 100. The figures were all drawn from the type material of *Aneura spiniloba.*

G, H. RICCARDIA SPECTABILIS (Steph.) Evans

G. Transverse section of axis, x 100. H. Transverse section of ultimate branch, x 100. The figures were both drawn from a specimen of *Aneura spectabilis* collected on Desolation Island by P. Dusén, No. 166.

can sometimes be distinguished, and sometimes, when the wings are defined with especial clearness, the surface-cells of the branches show distinct trigones. The interior cells are more or less elongated and have thickened walls. The primary branches are intermediate in structure between the axis and the secondary branches.

It should be mentioned that some of the secondary branches and even some of the primary branches toward their tips, instead of being flattened and winged, are subterete and quite wingless. These might be interpreted as stolons, but they are far less differentiated than the remarkable stolons found in *R. prehensilis* and *R. Thaxteri.* In addition to the photosynthetic branch-systems an axis of *R. calva* sometimes gives rise to one or two branches which represents new axes; these arise in place of photosynthetic systems and soon show the characteristic axial type of branching.

Sexual branches have not been observed by the writer and male branches are apparently still unknown. According to Schiffner the female flower is situated in the axil of a "lobule" and contains from ten to twelve archegonia; Stephani adds that the margin of the female flower is shortly lacinulate; but neither writer describes the "calyptra" or sporophyte. Schiffner's figure shows less regularity than is usually present, but the left-hand side of the thallus represented is fairly typical.

Some of the important differential characters of *R. calva*, when compared with *R. Savatieri*, have already been brought out, especially those relating to size, to the complexity of the photosynthetic branch-systems, and to the differentiation of the sclerotic zone in the axes. The following additional distinctions may now be emphasized: in *R. calva* the surface-cells do not project, the thallus in consequence does not appear velvety, and the marginal cells of the wings are not differentiated as a hyaline and crenulate border; in *R. Savatieri* the surface-cells usually project, the thallus in consequence does appear more or less velvety, and the marginal cells of the wings (at least on the ultimate branches) are clearly differentiated as a hyaline and crenulate border.

7. Riccardia Spegazziniana Massal.

Riccardia Spegazziniana Massal. Nuovo Gior. Bot. Ital. **17**: 254. *pl. 25, f. 32.* 1885.

Aneura Spegazziniana Steph. Hedwigia **32**: 138. 1893.
Aneura spiniloba Steph. Kungl. Svenska Vet.-Akad. Handl. **46**[9]: 9. *f. 1, g.* 1911.

SPECIMENS EXAMINED: Staten Island, 1882, *Spegazzini* (Massal., type, M.); Borja Bay, Straits of Magellan, Voyage of the "Albatross" (U. S., Y., listed by the writer as *Aneura multifida* (?), **8**, p. 141); without definite locality, Tierra del Fuego, 1896-97, *Hatcher* (Y., listed by the writer as *A. Spegazziniana,* **9**, 410, and **10**, p. 38); Skyring, Ensenada Rodriguez, southern Patagonia, 1908, *Halle & Skottsberg* (U., type of *Aneura spiniloba*).

The species has been reported from the following additional localities: Otway Bay and Desolation Island, *Savatier*, and Hermite Island, *Hariot* (**2**, p. 243); Desolation Island, *Dusén* (**29**, p. 9, as *Aneura Spegazziniana*); Almirantazgo, Tierra del Fuego, *Skottsberg* (**32**, p. 9, as *A. Spegazziniana*).

In *R. Spegazziniana* a more or less regularly pinnate thallus, showing a clear distinction between the axis and the branches, is again observable. The plants are described as erect by Stephani, and this is probably their natural position, but it would be difficult to reach a definite conclusion on this point from the material at hand. They apparently grow in loose tufts, with or without admixture, and vary in color from pale to dark brown, becoming almost black in the older parts. No rhizoids have been demonstrated by the writer.

The flattened main axis is rigid, becoming leathery when moistened, and exhibits long-continued growth, reaching a length of 13 cm., according to Stephani, but usually only 6-9 cm. long. Its width usually varies from 1 mm. to 2 mm. but may be as much as 3 mm.; its thickness is usually only 0.5-0.6 mm. In cross section (FIG. 3, C) the thallus shows a somewhat biconvex outline, the ventral edge bulging less than the dorsal; the ends of the section are obtuse or subacute. In the median part the axis is mostly ten to twelve cells thick, and the thinning out toward the sides is very gradual, no marginal wings being discernible. The axis is bounded on the outside by a single layer of small cells with slightly thickened walls. On the lower surface a broad median band (not shown in the figure) can be distinguished, in which the cells are about 28 μ long and only 16-20 μ wide; elsewhere the surface-cells are a little broader, averaging about 25 μ in width along the margin. Between these small surface-cells and the larger cells which make up the interior of the axis the transition is very abrupt. The interior cells are mostly 150-200 μ long and 50 μ wide but toward the edge the width may be as much as 100 μ. These large interior cells, which are mostly thin-walled, can be seen clearly through the small-celled surface layer, and constitute one of the most striking features of the species.

The ordinary branches spread obliquely or widely and are usually 3-5 mm. apart on each side of the axis. Although they tend to be opposite their arrangement is far from definite. In rare instances an axial branch is developed. The ordinary branches are quickly limited in their growth and are usually only 3-6 mm. long, although (according to Stephani) they may sometimes reach a length of 10 mm. They taper gradually toward the apex, their greatest width being mostly 0.7-0.9 mm., and may be either flattened or terete in the outer part. In most cases a primary branch bears one, two or (rarely) three secondary branches on each side, the latter being only 0.3-1.2 mm. long and 0.2-0.3 mm. wide. These secondary branches likewise taper and may be flattened but are much more likely to end in terete and spine-like points. The primary branches (FIG. 3, D, E) show a structure similar to that of the main axis, but the median portion is only eight or nine cells thick and the contrast in size between the superficial and interior cells is less marked, the marginal cells being often 30 μ wide and 50 μ long. The terete branches, which are often decurved, show an almost circular section (FIG. 3, F), about six cells across in every direction, and the cell differentiation is very slight. Even here, however, the small-celled band, which forms so marked a feature of the main axis and primary branches, can still be distinguished as a strip only a few cells wide.

Massalongo's description of *R. Spegazziniana* was drawn wholly from sterile material, and the writer has been unable to demonstrate either male or female inflorescences in the specimens at his disposal. According to Stephani the female inflorescence is borne on a very short and thick decurved pinnule, strongly papillose in the outer part; but he gives no information regarding the male inflorescence or the structures derived from the fertilized archegonia.

Stephani's description and figure of *Aneura spiniloba* are misleading in one or two respects. According to his statements the main axis is winged by two rows of large cells, and these are clearly shown in his figure, which represents the transverse section of a primary branch. He makes no mention, however, of a small-celled superficial layer covering over the large cells completely, and this layer is not indicated in any way in his drawing. The type specimen of *A. spiniloba* shows this layer clearly and also the median band of narrow cells on the lower surface, agreeing in both these respects with the type of *R. Spegazziniana*. This ventral band of narrow cells deserves special mention. The cells project a trifle and give the surface a slightly velvety appearance. Since they are considerably thicker than wide, they look as if they might have some secretive function. The band varies in width according to the width of the axis or branch upon which it is situated, but it persists (as already pointed out) even on terete branches.

8. **Riccardia spectabilis** (Steph.) comb. nov.

Aneura spectabilis Steph. Bull. Herb. Boissier 7: 746. 1899.

Specimens examined: Puerto Angosto, Desolation Island, 1896, *Dusén 166* (U., listed by Stephani as *A. spectabilis*, **29**, p. 9); Rio Azopardo, Tierra del Fuego, 1896, *Dusén 35* (N. Y., listed by Stephani as *A. spectabilis*, **29**, p. 9); without definite locality, Tierra del Fuego, 1896-97, *Hatcher* (Y., listed by the writer as *A. calva*, **9**, p. 410, and **10**, p. 38); Port Gallant, *Cunningham* (M.).

The species has likewise been reported from the following localities, under the name *Aneura spectabilis*: Rio Grande, Tierra del Fuego, *Dusén* (**29**, p. 9); Clarence Island, *Racovitza 178c* (**30**, p. 3); Lake Fagnano, *Skottsberg* (**32**, p. 9).

Although *R. spectabilis* is usually less robust and paler than *R. Spegazziniana*, the two species are closely related, and the following description will bring out many points in common. According to Stephani *R. spectabilis* is procumbent or erect among mosses, but the scanty material studied by the writer hardly shows what the habit really is. The plants are pale brown, becoming darker with age, but never showing the almost black hue characteristic of *R. Spegazziniana*. In a few cases rhizoids were observed and were quite indefinite in their position.

The main axis is usually 3-5 cm. long and continues its growth indefinitely. It is strongly flattened, being 1-1.5 mm. in width and only 0.4-0.5 mm. in thickness. In cross section (FIG. 3, G) it presents a biconvex outline, bulging more ventrally than dorsally, and the ends are rounded or subobtuse, no indications of a wing being present. The cell-differentiation is similar to that of *R. Spegazziniana* but presents a number of interesting differences. The superficial small-celled layer, for example, instead of being one cell thick throughout, is two or three cells thick in the median portion and one cell thick toward the margins. The cells measure about 30 μ in length and 14-16 μ in width, no ventral band of narrower cells being differentiated. There is, nevertheless, a gradual increase in width toward the edge, some of the marginal cells measuring 35 x 30 μ. The outer walls of the surface layer are sometimes slightly but distinctly thickened, the thickenings extending along the radial walls; otherwise the small cells are thin-walled. The interior cells of the thallus average about 38 μ in diameter and are usually 80-150 μ long. There is therefore a sharp contrast in size between the outside cells and the interior cells, although the difference is less marked than in *R. Spegazziniana*. Most of the interior cells are thin-walled, but in one or two layers just within the small-celled layers the walls are slightly and uniformly thickened and may even be pigmented.

Aside from the rare axial branches the thallus of *R. spectabilis* is regularly pinnate, the primary branches arising on each side of the main axis at intervals of 1-3 mm. They spread obliquely to widely and usually attain a width of 0.5-1 mm. and a length of 3-4 mm., their growth being soon brought to the end. These branches are flattened, at least at the base, and bear from one to three secondary branches on each side, sometimes close together and sometimes farther apart. The secondary branches, which are mostly 0.5-1.5 mm. long and 0.3-0.5 mm. wide, are usually simple but sometimes bear one or two very short tertiary branches. Any branch of whatever rank may taper into a subterete apical portion, but the primary branches are usually flat throughout.

In their histological features the branches resemble the main axis, except that their cell-differentiation is less pronounced. The ultimate branches (FIG. 3, H) are about six cells thick in the median portion, and the surface-cells run smaller than the interior cells. At the same time the small-celled layer is less definite than in the axis and is rarely more than one cell thick. Toward the margin a gradual increase in the size of the surface-cells is often apparent, quite as in the axis, and the edges may be bounded by a vague and interrupted row of cells, but there is never anything distinct enough to be called a wing. The walls of the cells are either thin throughout or only slightly thickened. The subterete branches are broadly elliptical in section and rounded at the edges; they are about ten cells wide and eight cells thick, and the small-celled superficial layer is almost as distinct as in the flattened branches.

The male inflorescences are borne on short and strongly decurved branches, arising directly from the main axis or from a primary branch. A male branch is usually simple but may be subdivided into two or three widely spreading secondary branches. Each inflorescence is terminal and occupies nearly the whole of a branch. It is usually 0.5-1 mm. long by 0.6 mm. wide and apparently never proliferates. The wings are three or four cells broad and crenulate from projecting cells; the antheridia are usually from six to ten; and the openings of the antheridial chambers are separated by two, rarely by three, rows of cells. No female plants have been seen by the writer. According to Stephani the female branch is very short and springs directly from the main axis near the base; it is bordered by a broad and delicate, deeply papulose-crenulate wing and is rounded in the apical portion. The "calyptra", still very young, is described as papulose from inflated cells, but the occurrence of a corona is questioned.

None of the preceding species show much resemblance to *R. Spegazziniana* and *R. spectabilis.* Perhaps *R. calva* comes as close to them as any, agreeing with them in the way it branches and in the fact that its superficial layer is composed of relatively small cells. But *R. calva* is a more slender species; it shows fairly distinct wings, even if these are three cells thick; the difference in width between the axis and the branches is less pronounced; the interior cells of the thallus average less in diameter, so that there is less contrast between them and the surface-cells; and the sclerotic zone of the axis, although not very distinct, is nevertheless more clearly indicated. It differs further from *R. Spegazziniana* in having no ventral band of narrow cells and from *R. spectabilis* in being bounded by a single layer of small cells.

9. **Riccardia corralensis** (Steph.) comb. nov.

Aneura corralensis Bull. Herb. Boissier 7: 742. 1899.

SPECIMENS EXAMINED: on earth, Port Corral, 1896, *Dusén 516* (St., type of *Aneura corralensis*). Known only from the type locality.

The branching of *R. corralensis* is fairly regular and the distinction between the main axis and those of lower rank is clear. At the same time the differentiation of the thallus, both in its gross structure and in its histological features, is less marked than in the species which have gone before. The plants grow in compact tufts and are pale green, becoming brownish with age. So far as the material at hand indicates they are at first prostrate but gradually turn upward, so that the apical portion assumes an ascending or suberect position. In spite of their apparent delicacy the plants exhibit a considerable amount of rigidity. Neither rhizoids nor clearly differentiated stolons have as yet been demonstrated.

The main axis shows long-continued growth. In some cases the apex was blunt, showing that growth had not yet been suspended; in other cases the axis gradually narrowed to a blunt point, showing that growth had come to an end (FIG. 4, A). The axis is usually only 1.5-2 cm. long, 0.35-0.5 mm. wide, and 0.25 mm. thick. It is distinctly flattened but shows a biconvex outline in cross section (FIG. 4, B), the ventral convexity being greater than the dorsal. At the ends the section varies from rounded to subacute, and the margin sometimes shows in surface-view an interrupted and irregular row of cells or even a double row, never distinct enough to be called a wing. The median portion of the axis is mostly eight to ten cells thick. The cells of the superficial layer are slightly convex and distinctly smaller than the interior cells. In the median portion of the axis they average about 17 μ in width; toward the margin they gradually increase to a width of 20-25 μ. The interior cells average about 140 x 40 μ. The cells are thin-walled throughout.

The primary branches spread obliquely and are given off from the main axis at intervals of 1-3 mm. In rare instances a primary branch represents a new axis, but it is usually limited in growth after attaining a length of 2-4 mm. The ordinary primary branches are mostly 0.15-0.3 mm. wide and may be either blunt or pointed at their apices. On each side they usually give off two or

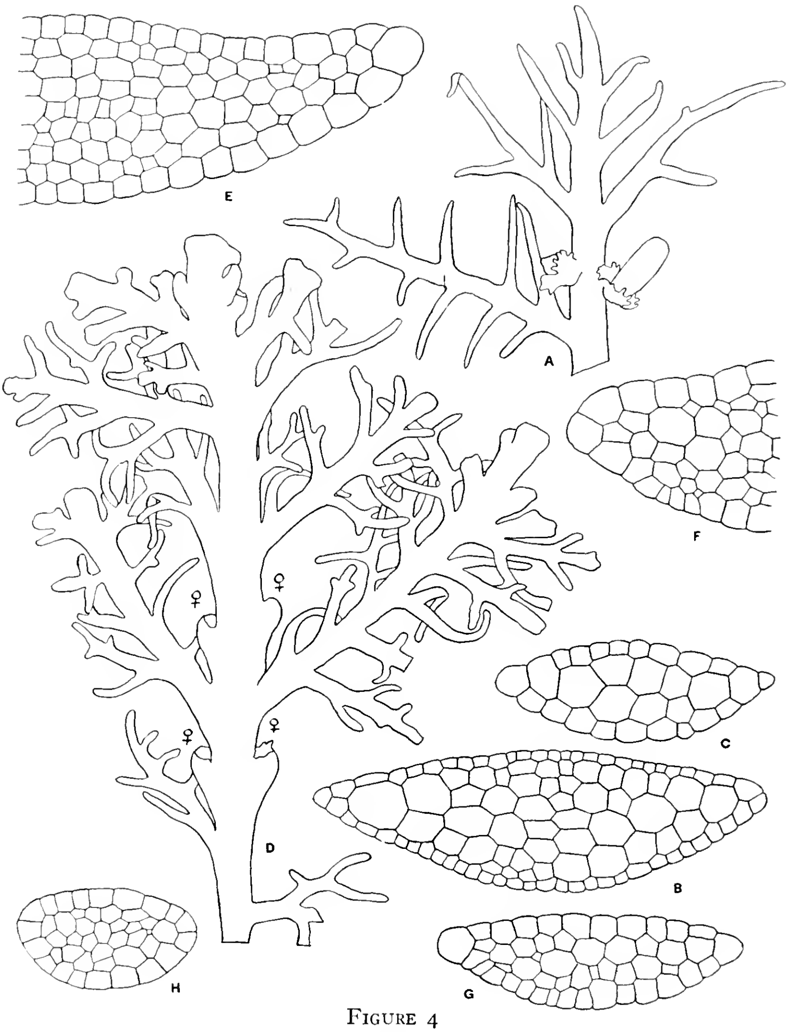

FIGURE 4

A-C. RICCARDIA CORRALENSIS (Steph.) Evans

A. Part of thallus with two female branches, x 8. B. Transverse section of axis, x 100. C. Transverse section of ultimate branch, x 140. The figures were all drawn from the type material of *Aneura corralensis.*

D-H. RICCARDIA CHILENSIS (Steph.) Evans

D. Part of thallus with four female branches, x 8. E. Transverse section of axis, showing one end, x 100. F. Other end of section partly shown in E, x 100. G. Transverse section of ultimate branch, x 100. H. Transverse section of stolon, x 100. The figures were all drawn from the type material of *Aneura chilensis.*

three secondary branches, 0.5-1.5 mm. long and 0.1-1.5 mm. wide, and these are usually tapering. In case the main axis itself tapers there is a tendency for the primary branches to become shorter and less subdivided as the apex is approached, some in fact remaining perfectly simple. In their histological features the branches resemble the main axis. The secondary branches (Fig. 4, C) and the apical portions of the primary branches are usually only four cells thick in the median portion, and the cells of the surface-layer are relatively larger than in the axis. In some cases the marginal row or double row is especially distinct, and it would not be stretching a point to say that a narrow wing was present.

Only a few male branches, all of which sprang directly from the main axis, have been observed by the writer. An inflorescence occupies nearly the whole of a branch and is usually 0.4-0.9 mm. in length by 0.3-0.35 mm. in width. It bears a spreading crenulate wing, usually only one or two cells wide, and from six to twelve antheridia, the openings into the antheridial chambers being usually separated by two rows of cells. The female inflorescences are borne on very short and broad primary branches and never proliferate. They are bounded by a wing two to four cells wide and crenulate along the margin from projecting cells; in rare cases blunt teeth one or two cells long are present. Between the wings and the archegonia a narrow crenulate ridge can be distinguished, constituting with the wings the involucre of the inflorescence. Only two to four archegonia are produced by each inflorescence. According to Stephani the "calyptra" is cylindrical, thick, smooth, rounded at the apex and destitute of a corona. These statements are fully confirmed by the very immature "calyptras" in the specimens examined, except that a low corona can be distinguished.

10. **Riccardia chilensis** (Steph.) comb. nov.

Aneura chilensis Steph. Kungl. Svenska Vet.-Akad. Handl. **49**[9]: 6. *f. 1, b.* 1911.

Specimens examined: in woods, Huafo Island, southern Chile, 1908, *Skottsberg 68* (U., type of *Aneura chilensis*). Known only from the type locality.

There are certain resemblances between *R. corralensis* and *R.*

chilensis in size, in color and perhaps in general habit, but the latter species can be at once distinguished by its much more copious and irregular branching and by differences in anatomical structure. In the type material the plants are growing in mixed tufts with other bryophytes and show a pale green color, becoming yellowish with age. Here again it is difficult to determine the habit beyond a doubt, but the thallus presents the appearance of being prostrate or decumbent, with the apical portion perhaps ascending. The rhizoids present are largely restricted to the stolons, which are not very highly differentiated.

The main axis (FIG. 4, D) continues its growth indefinitely and terminates in a broad and truncate apical region; in this respect it differs from *R. corralensis* where the axis sometimes narrows to a blunt point. The axis differs also in being wider, usually 0.8-1 mm. across instead of only 0.35-0.5 mm., but the length of the living portion, 1.5-2 cm., is essentially the same. The thickness of the axis is about 0.3 mm., indicating a considerable degree of flattening. Each surface is somewhat convex, the ventral a trifle more than the dorsal, and the latter sometimes shows a tendency to be slightly concave in the outer part. From the median portion, which is usually eight or nine cells thick, the thallus gradually thins out to the margin, which appears blunt in cross section. In the median portion the surface-cells measure about 40 μ in width and 40-60 μ in length; toward the margin a gradual increase in width is shown, the marginal cells averaging about 50 x 50 μ and forming an indistinct and often interrupted row. The interior cells of the axis are mostly 120-160 μ in length, but their diameter is about the same as that of the surface-cells. The cross section, therefore (FIG. 4, E, F), does not show an abrupt change in size between the surface-cells and the interior cells, differing in this respect not only from *R. corralensis* but also from *R. spectabilis* and *R. Spegazziniana*. The cell walls in *R. chilensis* are thin or slightly and uniformly thickened; sometimes the walls of the layer just within the surface layer are a little thicker than the others, but this difference is almost imperceptible. No pigmentation of the walls has been observed.

The primary branches arise close together, especially toward the apex of the thallus. In many cases they are only 1 mm. apart on each side and they may be even more crowded. They spread obliquely and some of them, although narrower than the main axis, show a blunt apex and long-continued growth. Since these branches tend to increase in width it is probable that they would develop into new thalli under suitable conditions. Branches with long-continued growth are mostly 0.4-0.6 mm. wide and may reach a length of 1 cm. or more. Other branches are narrower and shorter, their growth being soon brought to an end. All the primary vegetative branches give off numerous secondary branches and these in turn usually give off tertiary branches, so that the apical portion of the thallus represents a broad and complicated photosynthetic branch-system. The flattened ultimate branches, whether secondary or tertiary, are mostly 0.4-1 mm. long and 0.2-0.3 mm. wide. In some cases tertiary branches or the apical portions of secondary branches become subterete with rounded sides and may be interpreted as stolons. The flattened ultimate branches (Fig. 4, G) are mostly ten to twelve cells broad and four cells thick in the middle; they are similar in structure to the main axis and the marginal row of enlarged cells is sometimes fairly distinct. The stolons (Fig. 4, H) are mostly eight or nine cells broad and six or seven cells thick, and the surface-cells along the edges are scarcely larger than the others.

Stephani's description and figure give a good idea of *R. chilensis,* and he lays especial emphasis on the marginal row of cells. According to his account the type material was sterile. The writer has been fortunate enough, however, to separate out a few female plants and is thus able to give some idea of the female branches. These, in most cases, arise directly from the main axis and are exceedingly short. In a single instance a branch had proliferated and grown out into a subdivided strap-shaped extension. The upper surface of the branch is directed forward rather than upward, and very few archegonia are developed. The wings, which are apparently the only involucral structures formed, are mostly two to four cells broad and vaguely crenulate or denticulate from projecting cells. The very young "calyptra" shows a small corona and a surface roughened by cells which are splitting off. A single fragment with four short and simple male branches has likewise been distinguished, but the inflorescences are poorly preserved and show no features clearly except the spreading wings one cell broad.

11. Riccardia alcicornis (Hook. f. & Tayl.) Trevis.

Jungermannia (*Aneura*) *alcicornis* Hook. f. & Tayl. Jour. Bot. 3: 479. 1844.

Aneura alcicornis Tayl. & Hook. f. in G. L. & N. Syn. Hep. 499. 1846.

Riccardia alcicornis Trevis. Mem. Ist. Lombardo III. 4: 431. 1877.

Aneura subnigra Steph. Kungl. Svenska Vet.-Akad. Handl. 46[9]: 9. *f. 1, h.* 1911.

Specimens examined: Hermite Island, *Hooker* (M., type of *Jungermannia alcicornis*); Puerto Angosto, Desolation Island, 1896, *Dusén 165* (N. Y., as *Aneura tenax,* and apparently listed under this name by Stephani, **29**, p. 9); Peel Inlet, 1908, *Skottsberg 83* (U., the first specimen cited by Stephani under *A. subnigra*).

The following additional localities from the literature may be cited; Port Famine, Straits of Magellan, *Andersson* (**1**, p. 13, as *Jungermannia alcicornis*); Skyring, *Skottsberg* (**32**, pp. 5 and 9, as *A. alcicornis* and *A. subnigra*).

There is little to connect *R. alcicornis* with any of the preceding species. In some respects it shows an approach to *R. corralensis,* but there are striking differences in histological detail as the following description will demonstrate. The plants studied grew in loose tufts in admixture with other bryophytes. They vary in color from pale to dark green and sometimes exhibit a purplish black hue even while still young. So far as dried material indicates, the plants were prostrate or perhaps ascending at the tips and produced rhizoids abundantly wherever they came in contact with the substratum. The amount of differentiation shown is less than in most antarctic species of the genus.

The main axis with its long-continued growth (Fig. 5, A-C) reaches a length of 0.5-1 cm. (or even 2 cm. according to Stephani); its width is mostly 0.4-0.6 mm., and its thickness about 0.2 mm. In cross section (Fig. 5, D) it shows a biconvex outline with rounded ends, the ventral surface being more bulging than the dorsal. No indication of a marginal wing is present. The cells are unusually narrow and the contrast in width between the superficial cells and the interior cells is very slight. This is well brought out by the measurements, the surface-cells averaging about 27 x 12 μ and the interior cells measuring 50-70 μ by about 17 μ. The cross section of the axis shows a width of sixteen to eighteen cells and a thickness of eight to twelve cells. Most of the walls are thin, but the second and third layers of cells from the outside sometimes show slightly and uniformly thickened walls. No pigmentation of the walls has been observed.

At intervals of 0.5-1.5 mm. the axis gives off obliquely spreading branches (FIG. 5, A-C). An occasional branch shows long-continued growth and repeats the features of the axis. Most of the branches, however, are shorter and limited in growth, in spite of their blunt apices, attaining a length of perhaps 1.5-2 mm. and usually measuring 0.3-0.4 mm. in width. Each of these shorter branches usually bears two or three secondary branches on each side, a gradual decrease in length being often apparent in passing from base to apex. The secondary branches are mostly simple, but the longer branches toward the base sometimes give off from one to three short tertiary branches. The secondary branches are about 0.2 mm. wide and the tertiary 0.12-0.15 mm. The branches of whatever rank are similar in structure and are apparently never differentiated as stolons. There is, however, a tendency for the surface-cells on the branches to be wider than on the axis (FIG. 5, E), attaining a width of perhaps 16 μ, so that the contrast in size in section view is even less marked. Some of the branches, moreover, thin out toward the edges, appearing subacute in section, and an interrupted row of marginal cells can sometimes be distinguished.

The male branches arise directly from the main axis (or from one of the large axial branches). The inflorescence, which is usually 0.3-0.4 mm. long and 0.2-0.25 mm. wide, occupies nearly the whole of the branch and very rarely proliferates. The spreading wings are one or two cells wide and entire or nearly so, the marginal cells projecting very slightly or not at all. The features of the antheridial chambers are not clearly shown in the material at hand, but the antheridia usually number from four to eight. The archegonia, so far as observed, never exceed four, and the branches show no signs of proliferation. The involucre consists of a wing which is mostly four to six cells wide and variously lobed or lacerate, the lobes being either blunt or sharp. Sometimes the wing is supplemented by a few similar outgrowths

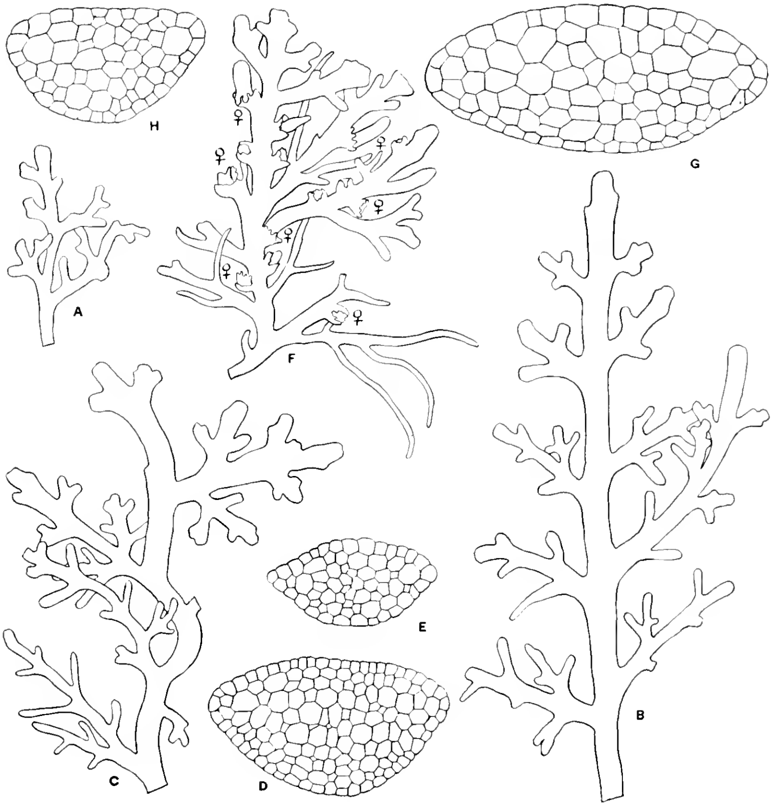

FIGURE 5

A-E. RICCARDIA ALCICORNIS (Hook. f & Tayl.) Trevis.

A-C. Parts of thalli, x 8. D. Transverse section of axis, x 100. E. Transverse section of primary branch, x 100. A was drawn from the type material of *Jungermannia alcicornis;* B-E, from a specimen of *Aneura subnigra* collected at Peel Inlet by C. Skottsberg, No. 83.

F-H. RICCARDIA FUSCOBRUNNEA (Steph.) Evans

F. Part of female thallus with numerous female branches and several proliferations, x 8. G. Transverse section of axis, x 100. H. Transverse section of primary branch, x 100. The figures were all drawn from the type material of *Aneura fuscobrunnea.*

among the archegonia. The "calyptra" when mature is about 2.5 mm. long and 0.8 mm. wide; the corona is low and hardly distinguishable except when young, and the surface is roughened by the peeling off of cells.

The published descriptions of *R. alcicornis* imply a certain amount of dichotomy in the thallus. According to the original account the plants are bipinnately branched, but it is added that the "rami seu laciniae" are "basi subdichotomi superne subpinnatim divisi." The idea of dichotomy is brought out still more clearly in the Flora Antarctica figure (32, *pl. 160, f. 8*), while Stephani states definitely that the "truncus" is "repitito furcatus . . . . furcis regulariter bipinnatis." He expresses a similar idea in his description of *Aneura subnigra,* where he states that the "frons" is "superne furcata, furcis dense regulariterque tripinnatis". Unfortunately the original specimens of *Jungermannia alcicornis* and *Aneura subnigra,* as the accompanying figures will show, fail to support these statements. As already noted, a branch is sometimes produced which approaches or even equals the main axis in size and in the complexity of its subdivisions, but branches of this type occasionally occur in most species where the branching is typically pinnate and are not a sufficient reason for designating these species "dichotomous." On the whole it is the pinnate feature in the branching of *R. alcicornis* which is really distinctive.

Stephani's description of *Aneura subnigra* is very brief and brings out no features which would distinguish the species from *R. alcicornis.* The specimens in fact agree in all essential particulars. His figure of *A. subnigra,* representing the cross section of a primary branch, is highly diagrammatic and shows an improbable regularity in the form and arrangement of the cells. The blackish color, which would account for his specific name, is by no means constant. When it occurs it is due to minute bluish black bodies inside the cells, but the nature of these bodies has not been determined. They are of about the same size as the chloroplasts. In the description of *Jungermannia alcicornis* a blackish coloration is mentioned in connection with old and dry plants, and an occasional branch of the type specimen shows brownish or blackish particles in some of the cells. They are less distinct, however, than in the specimens of *A. subnigra,* owing perhaps to the much greater age of the material.

12. **Riccardia fuscobrunnea** (Steph.) comb. nov.

Aneura fuscobrunnea Steph. Kungl. Svenska Vet.-Akad. Handl. 46^9: *7. f. 1, d.* 1911.

SPECIMENS EXAMINED: on banks of a brook, western end of Lago Fagnano, Tierra del Fuego, 1908, *Halle* (U., type of *Aneura fuscobrunnea*). Known only from the type locality.

Although *R. fuscobrunnea* is so variable that it is difficult to picture its distinctive features clearly, the species is evidently a close relative of *R. alcicornis.* The original specimens are pale to dark brown, becoming blackish in the older parts. The plants grew in intricate tufts and the individual thalli look as if they had been prostrate with ascending tips. Rhizoids are apparently absent altogether.

In well-developed plants (FIG. 5, F) the main axis is 0.3-0.4 mm. wide, but it may be only 0.2 mm. wide in slender specimens. It shows long-continued growth, the living portion being mostly 0.5-1 cm. in length. It is distinctly flattened, the thickness being about 0.2 mm. and the cross section (FIG. 5, G) showing a biconvex outline with rounded ends. The convexity is usually more pronounced ventrally than dorsally but the difference is rarely very marked. Measured in cells an ordinary axis is twelve to sixteen cells wide and seven or eight cells thick in the median portion. The cell-walls are slightly and uniformly thickened, but the walls of the interior cells are somewhat thinner than the others. On the upper surface the cells of the outside layer are about 40 μ long by 30 μ wide; on the lower surface, about 40 x 22 μ. The interior cells are mostly 70-100 μ in length by 35 μ in diameter. When viewed in cross section the contrast in size is therefore relatively slight, especially when the interior cells are compared with those of the upper surface. In Stephani's figure, which represents the cross section of a branch, the contrast indicated is greater than in the specimens themselves.

The branching of the main axis is profuse, the branches being given off at intervals of 0.3-0.7 mm. on each side (FIG. 5, F). These branches spread obliquely and vary greatly in appearance. The most complicated are essentially like the main axis and show indefinite growth with a bipinnate branching. Others are shorter, soon limited in their growth and only once pinnate; still others are simple. The branches which are once pinnate are perhaps the most typical; they are usually 1.5-2 mm. long and 0.15-0.25 mm. wide. Even the narrowest branches are 0.1-0.12 mm. wide, and such branches may be primary, secondary or tertiary in rank. The branches are essentially the same in structure as the main axis, but some of them are even less flattened and in some cases the upper surface is almost plane (Fig. 5, H). On certain branches and even on the main axis a vague and interrupted row of marginal cells may sometimes be distinguished.

Only a few male branches have been observed. They bore a marked resemblance to those of *R. alcicornis*, except that the wings were slightly crenulate from projecting cells. In one case a simple proliferation, 1.5 mm. long and 0.15 mm. wide, had been developed. The very short female branches arise directly from the main axis or from the basal portion of one of the bipinnate branches. The archegonia are four or fewer and are protected, much as in *R. alcicornis,* by irregularly divided wings, two to four cells wide, the divisions being lobe-like and either blunt or sharp. Supplementary outgrowths in connection with the archegonia are apparently not developed. In many cases the female branch proliferates beyond the cluster of archegonia, and a proliferation in extreme cases may take the form of a pinnate or bipinnate branch-system. According to Stephani's account the young "calyptra" is villous with long hooked hairs. The writer regrets that he has been unable to demonstrate calyptras in the specimens at his disposal.

The numerous proliferations growing out beyond the female inflorescences are perhaps an indication that the type material of *A. fuscobrunnea* is abnormally developed. In some cases the interpretation of these outgrowths as proliferations is clear, since unfertilized archegonia can be demonstrated at the base. In other cases there are apparently no archegonia at the base of a "proliferation", although it still shows a cluster of lobe-like structures, similar to the wings of a female branch. Of course it is possible that unrecognizable vestiges of archegonia are present, even here, but it seems more probable that a female branch may have grown out into a sterile extension without having formed any archegonia at all.

In comparing *R. fuscobrunnea* with *R. alcicornis* certain resemblances are very striking. The two species are of about the same size; the branches show but little differentiation and are biconvex in section and usually rounded at the ends; the male inflorescences are much the same; and the clusters of archegonia are surrounded by lobe-like divisions. *R. fuscobrunnea,* however, is more copiously branched, the branches being often crowded together; and the cells are considerably larger, as the measurements given indicate.

13. Riccardia spinulifera Massal.

Riccardia spinulifera Massal. Nuovo Gior. Bot. Ital. **17**: 254. *pl. 26, f. 33.* 1885.

Spinella magellanica Schiffn. & Gottsche in Schiffner, V., Forschungsreise "Gazelle" $\mathbf{4}^4$: 42. *pl. 8, f. 17-19.* 1890.

Aneura spinulifera Steph. Hedwigia **32**: 138. 1893.

Specimens examined: dense forest of *Fagus betuloides,* Tuesday Bay, Straits of Magellan, 1876, *Naumann* (S., Y., type of *Spinella magellanica*).

The species has been reported from the following additional localities: Mt. Sarmiento, Tierra del Fuego, and Basket Island, *Spegazzini* (**16**, p. 255, including type); Desolation Island, *Savatier* (**2**, p. 244); Newton Island, *Dusén* (**29**, p. 19, as *Aneura spinulifera*).

In size and method of branching *R. spinulifera* resembles *R. alcicornis,* but the remarkable appendages described below will at once distinguish it, not only from *R. alcicornis* and its allies, but from all the other known species of *Riccardia.* The dried plants are a pale brownish green in the younger portions and a darker brown in the older. They apparently grew in loose tufts, often in admixture with other bryophytes, and produced neither stolons nor rhizoids. In all probability they were prostrate in habit, perhaps with ascending tips, but the scanty material available for study leaves this point in doubt.

The main axis, which is mostly 0.5-1.5 cm. long, 0.25-0.3 mm. wide and 0.18-0.2 mm. thick, continues its growth indefinitely. Although slightly flattened, the edges are rounded and show no indications of wings or differentiated marginal cells. The median portion is usually ten to twelve cells thick, and all the cells have slightly thickened and often pigmented walls, the walls of the interior cells being thinner than the others. The cells of the surface layer are mostly 20-30 μ long and 12-20 μ wide, while the interior cells are 70-120 μ long and about 25 μ in diameter.

The superficial cells of the axis and also of the branches are convex, and every cell (or nearly every cell) bears an outgrowth or appendage of some sort. In their simplest expression these outgrowths are single, bluntly pointed, superimposed cells, with the wall more or less thickened at the tip. If often happens, however, that the outgrowths of two or more adjoining cells are coalescent and thus give rise to more complicated appendages, the most complex of which are in the form of spinulose leaf-like lobes, four or five cells wide at the base and two to four cells long. In such an appendage nearly every cell is bluntly pointed with the wall thickened at the tip, and the cells which are not marginal often project at various angles. Between the simplest and the most complicated outgrowths are all possible gradations. The adjoining cells with coalescent outgrowths are usually in longitudinal rows but may be in slightly divergent rows. The outgrowths thus show a tendency to be longitudinal in position, but there is otherwise little regularity in their arrangement, and the whole surface of the thallus is so closely covered by its appendages that the outlines of the superficial cells are difficult to distinguish.

At intervals of 0.5-1.5 mm. on each side the axis gives off obliquely to widely spreading branches. Except in those rather rare cases where the branch represents a new axis, the branches are quickly limited in their growth, measuring usually 1-4 mm. in length and 0.15-0.2 mm. in width. They are either simple or bear from one to five secondary branches, which are shorter but scarcely narrower than the primary branches. Occasionally a very short tertiary branch is produced. The structure of the branches is essentially like that of the axis.

Both male and female branches are borne on the same thallus, the species being autoicous. The male branches are not abundant and always arise on primary branches in the material studied. The terminal inflorescence, which apparently never proliferates, sometimes occupies nearly the entire branch but is sometimes approached or even surpassed in length by the basal sterile portion of the branch. It measures 0.25-0.45 mm. in length and about 0.2 mm. in width, and the antheridia usually number five to eight. The whole surface of the inflorescence is covered with appendages;

these tend to be somewhat simpler than those on the vegetative axes but nevertheless make it difficult to demonstrate the other features of the inflorescence. So far as the writer could determine from the scanty material studied, the wings are suberect and only one cell wide, and the openings into the antheridial chambers are separated by a single row of cells.

The very short female branches arise directly from the main axis and here again the dense appendicular covering obscures the structure of the protective parts. In one instance a few leaf-like lobes with spinulose margins and surface and a length of six or seven cells could be distinguished. This agrees on the whole with Stephani's account (27, p. 738), which describes the margin of the branch as "longe lobati, lobis foliaceis bipinnatim spinosis." The largest "calyptra" seen was 1.5 mm. long and 0.6 mm. wide. At the tip was a distinct corona with short and irregular blunt outgrowths; the remaining surface bore short and relatively simple spinulose outgrowths in the upper part and rounded outgrowths toward the base.

The account just given adds but little to the descriptions already published by Massalongo, Schiffner and Stephani. The last author compares the species to a *Lepidozia* in its appearance and designates the appendages as "paraphyllia." This term would of course be appropriate if we regarded the thallus of *Riccardia* as a leafy stem which had lost its leaves. If, however, the thalloid condition is regarded as primitive the term becomes less applicable. In the original account of *R. spinulifera* Massalongo separates, under the name *"β, scabrifrons"*, a plant from Basket Island, in which the appendages are said to be less manifest and more appressed. This form, which is not mentioned by either Schiffner or Stephani, is quite unknown to the writer.

14. **Riccardia conimitra** (Steph.) comb. nov.

Aneura conimitra Steph. Bull. Herb. Boissier 7: 749. 1899.

Specimens examined: on rotten logs, Guaitecas Islands, western Patagonia, 1897, *Dusén* 403 (U., type of *Aneura conimitra*); Port Corral, 1905, *Thaxter* 55 in part (H., Y.).

The following additional station may be cited from the literature: Chiloé Island, *Skottsberg* (32, p. 6, as *Aneura conimitra*).

In size and method of branching *R. conimitra* resembles such species as *R. fuscobrunnea* and *R. alcicornis,* but the branches are perhaps a little more differentiated and the histological features afford good distinctive characters. Other important differences are derived from the sexual branches. The species is variable but the range of variability is still incompletely known, owing to the small amount of material available for study. The plants grow

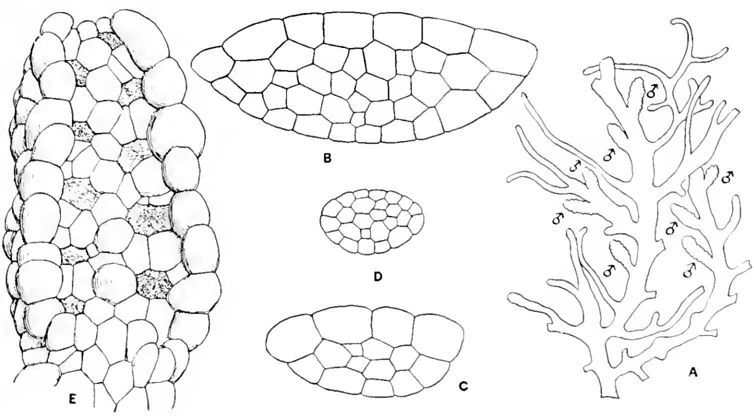

FIGURE 6. RICCARDIA CONIMITRA (Steph.) Evans

A. Part of male thallus with numerous male branches, x 8. B. Transverse section of broad axis, x 100. C. Transverse section of narrow axis, x 100. D. Transverse section of stolon, x 100. E. Male inflorescence, x 100. The figures were all drawn from the type material of *Aneura conimitra.*

in loose tufts, and the type-specimens are mixed with another species of *Riccardia,* too fragmentary for determination. The color varies from a yellowish to a brownish green, becoming darker with age but not blackish. Each thallus is apparently prostrate in the lower part and ascending or suberect above. The prostrate part gives out rhizoids sparingly, usually from very small surface-cells, but the upper portion of the thallus seems to lack rhizoids completely.

As in the allied species a well-developed axis (FIG. 6, A) shows long-continued growth and a blunt apex, usually attaining a length of 0.5-1 cm.; its width measures 0.3-0.45 mm. and its thickness nearly 0.2 mm. In some cases the axis itself becomes attenuate at the apex, indicating a cessation of growth, and in this respect resembles the majority of the branches. The upper surface of the axis is slightly convex and is covered over by a single layer of large cells (FIG. 6, B, C); the lower surface is more convex and the edges are rounded to obtuse. The large cells of the upper surface are mostly 80-160 μ long in the median portion and 60-80 μ wide; toward the edges they gradually become shorter, the marginal cells averaging about 50 μ in length and forming a more or less distinct border. The cells of the lower surface are almost as long as those of the upper surface but distinctly narrower, being only 30-50 μ wide. The interior cells measure 160-200 μ in length and average about 40 μ in diameter. In cross section the large cells of the upper surface stand in rather sharp contrast to the other cells and represent an unusual feature for the genus. The axis is usually four to six cells thick, and the cells are thin-walled throughout.

The axis gives off, usually at intervals of 0.6-0.9 mm. on each side, a series of obliquely spreading branches. A few of these represent new axes and branch in the same way as the main axis, but the majority are shorter and narrower and usually grow out into attenuate apices. These shorter primary branches usually give off a few simple secondary branches, these being still narrower and almost invariably attenuate. A few of the branches arising in the basal part of the thallus represent stolons; these are slender and usually simple, their width being mostly 0.1-0.12 mm. The ordinary branches show much the same structure as the main axis. The more slender examples are only four cells across on the upper surface and four cells thick in the median portion. The row of marginal cells is usually very distinct and the cells sometimes project as crenulations. The stolons (FIG. 6, D) are only slightly flattened and do not show a marginal row of cells; they are about five cells thick and their small cells, which average only 20 μ in width, show little differentiation.

The male branches, which are simple and apparently never proliferate, arise directly from the main axis or from an axial branch (FIG. 6, A). The inflorescence (FIG. 6, E) occupies nearly the whole of the branch and is usually 0.45-0.7 mm. long and 0.3 mm. wide. The wing, which is a single cell wide, is either suberect or obliquely spreading and its cells project as distinct crenulations. The antheridia vary in number from six to ten, and the openings into the chambers are commonly separated by single rows of cells. Sometimes these cells bulge upward, the upper surface of the inflorescence being thus slightly roughened. The writer has seen no female plants of *R. conimitra*. According to Stephani's description the female branch is very short and shortly lobulate along the margin, while the "calyptra" is smooth, subcylindrical, and tipped with a large corona. This structure, which gives the name to the species, is further described as being smooth, conical, obtuse, and composed of large connate cells, radiately disposed.

In the preceding description the attempt has been made to distinguish various kinds of vegetative branches. It should be understood, however, that these are connected by all possible intergradations. The large cells on the upper surface of the thallus, which represent one of the most distinctive features of *R. conimitra,* were emphasized by Stephani, although he made the error of referring them to the lower surface, rather than to the upper. On the slender branches these cells tend to be especially distinct. Unfortunately they are not always clearly differentiated. The stolons do not show them at all, and the ordinary flat branches sometimes exhibit a very slight contrast in width between the cells. Another feature which deserves emphasis is found in the narrow partitions between the antheridial chambers; even at the mouths these partitions are usually only one cell across, although in most species they are two cells across or more.

It will perhaps be sufficient to compare *R. conimitra* with *R. fuscobrunnea* and *R. alcicornis*. It is a far more flaccid plant than either of these species, owing perhaps to the much larger cells of which it is composed. The large cells on the upper surface, conspicuously wider than the other cells, afford another important distinction. In *R. fuscobrunnea* and *R. alcicornis* the contrast in width between the cells is very slight; and, if any contrast at all is present, it is the surface layer which shows the narrowest cells. The long and slender attenuate branches, which *R. conimitra* develops so freely, likewise deserve mention. Such branches are rarely or never produced by the other two species, where the ultimate branches are blunt and usually short.

15. **Riccardia autoica** (Steph.) comb. nov.

Aneura autoica Steph. Bull. Herb. Boissier 7: 691. 1899.

Specimens examined: on rotten logs, valley of the Rio Aysen, western Patagonia, 1897, *Dusén 298* (U., type of *A. autoica*).

Stephani cites the species also from Peel Inlet, *Skottsberg* (**32**, p. 6, as *Aneura autoica*).

In *R. autoica* a type of thallus is met with that stands in sharp contrast to those already described. The distinctive features will be brought out in the following account, but it may be noted at once that the plants have a distinctly prostrate axis, closely adherent to the substratum by means of rhizoids. They are therefore either scattered or grow in depressed mats. The type material is apparently free from admixture. The plants are delicate in texture and pale yellowish green in color, sometimes becoming brown with age.

The axis is flattened and turns either the ventral surface (FIG. 7, A, B) or an edge (FIG. 7, C) to the substratum. It exhibits long-continued growth but in some cases at least the growth is eventually limited, the apical portion curving away from the substratum and developing directly into a photosynthetic branch-system. A typical axis is 1-1.5 cm. long, 0.4-1 mm. wide, and 0.25-0.3 mm. thick. The upper surface is plane or nearly so but the lower surface is distinctly convex. Toward each side there is a gradual thinning out, the edges being either rounded or bordered by a wing two or three cells wide. These features are brought out with especial clearness by cross sections, which show a plano-convex outline with rounded (FIG. 7, E) or acuminate (FIG. 7, D) ends. It often happens that one edge is winged and the other rounded. This condition is sometimes associated with an axis turning one edge to the substratum, but it may be associated with an axis turning its ventral surface to the substratum. A well-developed axis is nine or ten cells thick in the median portion. The surface-cells average about $50 \times 30\ \mu$ and the interior cells are usually 80-150 μ long but only 30 μ wide. The cross section therefore shows little or no contrast in size. The surface-cells are thin-walled throughout; the interior cells have very slightly thickened walls.

The primary branches usually arise at intervals of 0.6-1.5 mm. on each side of the main axis (FIG. 7, A-C). Not infrequently a primary branch is prostrate and essentially like the main axis. In many cases, however, a primary branch gives rise at once to a photosynthetic branch-system, which spreads away from the substratum. Such a system, whether primary or secondary in origin, is quickly limited in growth; it attains a length of 2-3 mm. and is nearly or quite as wide as the axis. In the most typical cases the system shows two simple branches on each side, the basal branch being the longer of the two. These branches are 0.3-0.4 mm. wide and, together with the axis of the system, form a cluster of crowded or overlapping divisions with rounded ends. Unfortunately this typical condition, although often approximated, is rarely wholly realized. It is shown by the basal system in FIG. 7, C, part of which is hidden, and approximated by the next system, which shows two branches on one side and one on the other. The two basal systems in FIG. 7, B, are likewise almost typical. The other branch-systems shown in this figure seem to deviate widely from this description. Many of these systems, however, are still immature and might have acquired a more typical appearance if they had developed fully. The ultimate photosynthetic branches are distinctly winged on each side, the margin being crenulate from projecting cells. The wings are mostly two or three cells wide (FIG. 7, F) but may show a width of four or five cells. According to Stephani the wings are uniformly six cells broad, but the type material does not support this statement. The median portion of an ultimate branch is mostly five or six cells thick. In addition to the photosynthetic systems the axis sometimes gives rise to stolons (FIG. 7, C). These usually grow out from an edge turned toward the substratum and help to attach the thallus more firmly. The stolons show indefinite growth and sometimes bear scattered branches or branch-rudiments. They average about 0.25 mm. in diameter and are only slightly flattened, the median portion being seven or eight cells thick. They sometimes show narrow and interrupted wings, but are usually wingless throughout. FIG. 7, G, which represents the section of a stolon, shows a wing on one side and none on the other.

Stephani states that a female branch is short and lacinulate and that it gives off a male branch on each side at the base. He adds, however, that the male branches are sometimes borne singly at the bases of pinnules, thus implying that they are not always associated with female branches. In the writer's experience the sexual branches arise on entirely distinct individuals, and the species would have been described as dioicous without a doubt, if it had not been for Stephani's account. It is unfortunate that the specific name "*autoica*" should have been applied to a plant which is not more constantly autoicous.

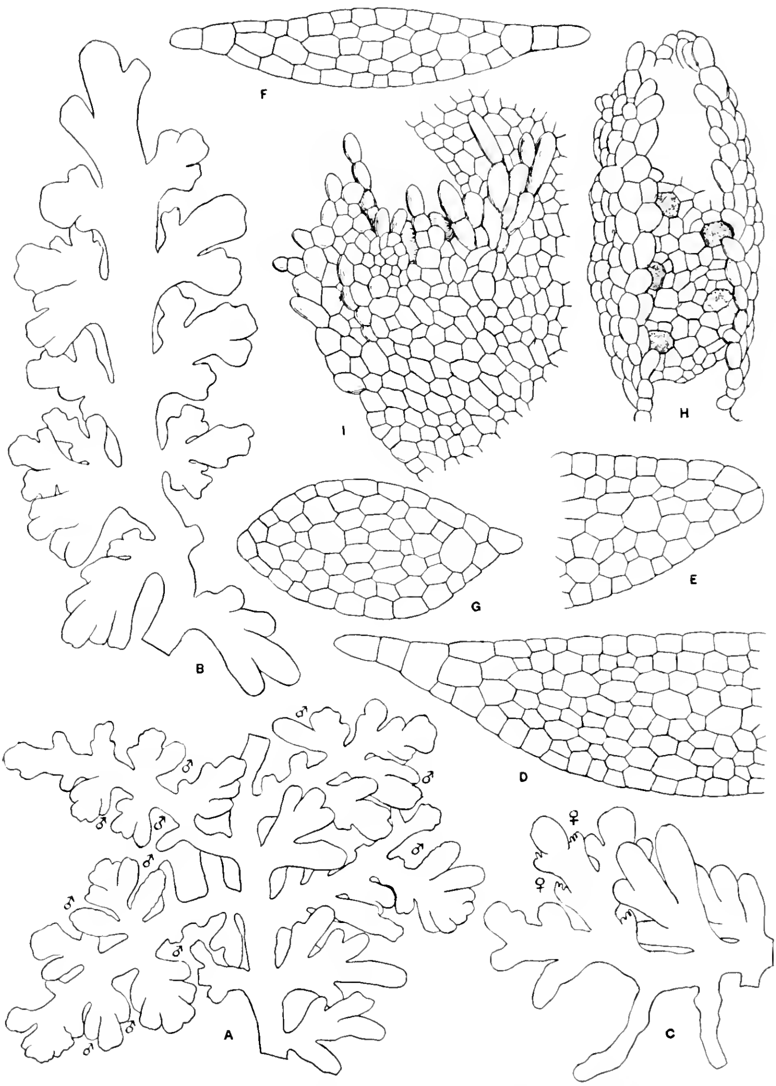

Figure 7. Riccardia autoica (Steph.) Evans

A. Part of male thallus with numerous male branches, x 8. B, C. Parts of two female thalli with several female branches, C showing two stolons, x 8. D. Transverse section of axis, x 100. E. Other end of section partly shown in D, x 100. F. Transverse section of ultimate branch, x 100. G. Transverse section of stolon, x 100. H. Male inflorescence, x 50. I. Female branch, ventral view, x 50. The figures were all drawn from the type material of *Aneura autoica.*

The male branches sometimes grow out directly from a main axis but they occur much more frequently in subopposite pairs at the base of a photosynthetic branch-system, where they represent the first two secondary branches. Sometimes there is only one male branch at the base of the system; sometimes one or both sides will show two such branches. The inflorescence (FIG. 7, H) occupies nearly the whole of the branch, measuring usually 0.7-1 mm. in length and 0.3-0.45 mm. in width, and so far no proliferations have been observed. The narrow wings, one or two cells wide, are sometimes erect but usually connivent, partially covering over the upper surface of the inflorescence, and their margins are irregularly crenulate from projecting cells. The antheridia are usually from six to ten; in one case fourteen were observed, and Stephani states that there are sometimes as many as twenty. The openings of the antheridial chambers are separated by three or four rows of cells, those immediately surrounding the opening sometimes forming a slightly elevated, complete or incomplete ring.

The female branches are exceedingly short and are similar in position to the male branches. In one case a short and simple proliferation could be demonstrated. The most conspicuous feature of the branch (FIG. 7, I) is a lobe-like outgrowth on the outside, lying in the same plane as the branch-system and crenulate, denticulate or short-ciliate along the edge. Apparently in the axil of this outgrowth a small cluster of archegonia, directed forward, is situated and this is protected by a double series of cilia or short-ciliate lobes, representing the wings of the branch and constituting the involucre of the inflorescence. These cilia or lobes are mostly two to five cells long. Stephani describes the "calyptra" as very large, thick and smooth, with a large corona constricted at the base.

On the whole the vegetative structure of *R. autoica* is clearly described in the original publication. When it states, however, that the axis gives off branches on one side and stolons on the other, a somewhat inconstant feature is emphasized as a specific character. When the plants are scattered and the axes are attached to the substratum by the ventral face, the branches on each side tend to be photosynthetic in character, and few or no stolons are produced. It is only when the plants become more crowded, so that the axes are attached by one edge, that the formation of stolons on one side and of photosynthetic branches on the other becomes a more usual phenomenon.

16. **Riccardia tenerrima** (Steph.) comb. nov.

Aneura tenerrima Steph. Kungl. Svenska Vet.-Akad. Handl. **49**^{9}: *9. f. 1, i.* 1911.

Specimens examined: on tree trunks, Puerto Chacabuco, near the mouth of the Rio Aysen, western Patagonia, 1907-1909, *Halle 85* (U., type of *Aneura tenerrima*). Known only from the type locality.

The relationship of *R. tenerrima* to *R. autoica* is close, and the species is therefore very distinct from any of the others that have been discussed. The plants are dark green, apparently showing very little variation in color, and the thalli, together with their vegetative branches, are prostrate and adherent to the substratum by means of numerous rhizoids. They are sometimes scattered and sometimes crowded together in thin mats. The texture is exceedingly delicate, and it is difficult to dissect off a plant without tearing it. No stolons have been observed.

The axis (Fig. 8, A) is strongly flattened, the upper surface being plane or nearly so and the lower slightly convex. In well-developed plants the axis is mostly 1-2 cm. long, thus exhibiting long-continued growth, while the width is 1-1.5 mm. and the thickness only 0.2-0.25 mm. The thinning out toward the sides is gradual, and an indistinct wing, one to four cells wide and only one cell thick, is usually present. The cross section is therefore acute to acuminate at the ends (Fig. 8, B). In the median portion the axis is only five or six cells thick. The surface-cells measure as a rule 60-120 μ in length and about 40 μ in width, while the interior cells are mostly 100-200 x 50 μ. The contrast in width is thus relatively slight. The cell-walls throughout are thin or very slightly and uniformly thickened.

The branches (Fig. 8, A) are exceedingly variable in length and in degree of subdivision, but are essentially like the axis in their structural features. The primary branches arise at intervals of 0.5-1.5 mm. on each side of the main axis and spread obliquely to widely. The longest are about 1 cm. long and nearly or quite as wide as the axis; they usually bear a series of simple branches on each side, these being usually 2-3 mm. long and 0.5-1 mm. wide; but sometimes a secondary branch bears tertiary branches, either vegetative or sexual in character. The shortest primary branches are like the simple secondary branches just described, and between these and the longest primary branches are many intermediate conditions. The ultimate branches of whatever rank are usually four cells thick in the median portion. Their wings are rarely more than three

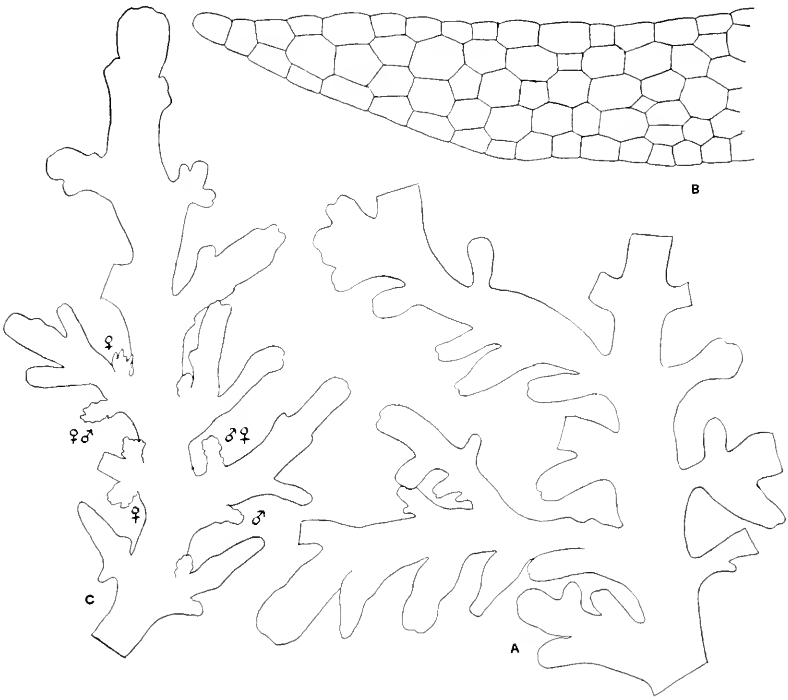

FIGURE 8

A, B. RICCARDIA TENERRIMA (Steph.). Evans

A. Part of sterile thallus, x 5. Transverse section of axis, x 100. The figures were both drawn from the type material of *Aneura tenerrima*.

C. RICCARDIA DIVERSIFLORA Evans

C. Part of thallus with two male, three female and two bisexual branches of different types, x 5. The figure was drawn from the type material.

cells wide and are crenulate from projecting cells, but less markedly so than in *R. autoica*. The surface-cells of the ultimate branches deviate slightly in size from those of the axis, the median cells being mostly 40-70 μ long and 35 μ wide, while the marginal average 35 μ in length and measure 20-30 μ in width.

Although Stephani attributes a dioicous inflorescence to his species, the type material (which seems to be quite free from admixture) is clearly autoicous. The male branches are sparingly produced and are short and simple, rising usually from the basal part of a primary or secondary branch, more rarely from the main axis itself. The inflorescence, which does not proliferate, is mostly 0.2-0.5 mm. long and about 0.25 wide. The wing is suberect, one cell wide and crenulate from projecting cells; the antheridia are mostly three to six; and the openings into the antheridial chambers are usually separated by two rows of cells, rarely by a single row.

The female branches, so far as observed, are exceedingly short and look as if they were immature. They are in the form of slightly projecting crenulate lobes, each bearing only one or two archegonia on the upper surface. The wings, hardly more than a cell wide, are vaguely crenulate or subentire and are sometimes supplemented by one or two papilla-like cells. According to Stephani the "calyptra" may attain a length of 4 mm. and is broadly cylindrical in form; the surface is roughened by large cells forming papilliform projections, these cells being transformed into hooked hairs in the upper part.

Gemmae are produced by *R. tenerrima* in considerable abundance. They are of the two-celled endogenous type characteristic of the genus and are broadly oval in outline, the length being usually 40-50 μ and the width 30-40 μ. The gemmae are borne on short branches with distinctly crenulate margins and arise in the usual way from cells of the surface-layer. The formation of gemmae quickly limits the growth of the branches. Gemmae are doubtless produced by other Chilean species of *Riccardia*, but *R. tenerrima* is the only one where the writer has observed them.

The type material of *Aneura tenerrima* is fairly abundant and yet gives the impression of being imperfectly developed, owing largely to its great delicacy. Taking this fact into consideration and noting the strong superficial resemblance of the species to *R. autoica*, the writer was at first inclined to regard it as an aberrant form of the older species, more especially since both are known from the vicinity of the Aysen River. There are, however, certain differential characters which are clearly sufficient to keep the two species apart. In *R. autoica*, for example, the thallus shows a differentiation into axis, photosynthetic branch-systems and stolons, even if these various types intergrade; in *R. tenerrima* no such differentiation is apparent. *R. autoica* is further distinguished by its smaller cells, averaging about 30 μ in width at least in the axis, and by its large and complex male spikes, the openings into the antheridial chambers being separated by three or four rows of cells; in *R. tenerrima* the cells are larger, the interior cells of the axis averaging about 50 μ in width, and the openings into the antheridial chambers of the much smaller male spikes are separated by only one or two rows of cells. The female branches are unusually short and lobe-like in both species, but the wings are ciliate in *R. autoica* and barely crenulate in *R. tenerrima*.

17. **Riccardia diversiflora** sp. nov.

Growing in depressed mats, pale or yellowish green varying to brownish: thallus apparently prostrate throughout, the axis strongly flattened but scarcely winged and rather copiously branched; branches narrower than the axis and often more distinctly winged but otherwise scarcely differentiated, usually sparingly subdivided, the secondary branches sometimes remaining in a rudimentary condition; inflorescence heteroicous, the sexual branches ♂, ♀ or ⚥: ♂ inflorescences borne singly, the wing obliquely spreading, irregularly crenulate, two or three cells wide, the antheridia mostly six to eight: ♀ inflorescence occupying a short and simple branch; involucre consisting of irregularly toothed or ciliate wings and scattered teeth or cilia among the archegonia; ⚥ branches showing an abrupt transition from one type of inflorescence to the other: remaining parts unknown.

Specimens examined: in swamp, Gente Grande, Tierra del Fuego, 1895, *Dusén 25* (U., cited by Stephani under *Aneura floribunda*, **29**, p. 8). Known only from the type locality.

The present species is amply distinct from *Aneura floribunda*, with which it has been confused. It is apparently closer to *R. autoica*, although more robust, but even with this species the relationship is not very near. The plants are pale green or yellowish, becoming pale or dark brown with age, and are loosely tufted in admixture with other bryophytes. They are apparently prostrate throughout or perhaps ascending at the tips, and the only rhizoids observed have been situated on the sexual branches.

The axis, as usual, shows long-continued growth and is com-

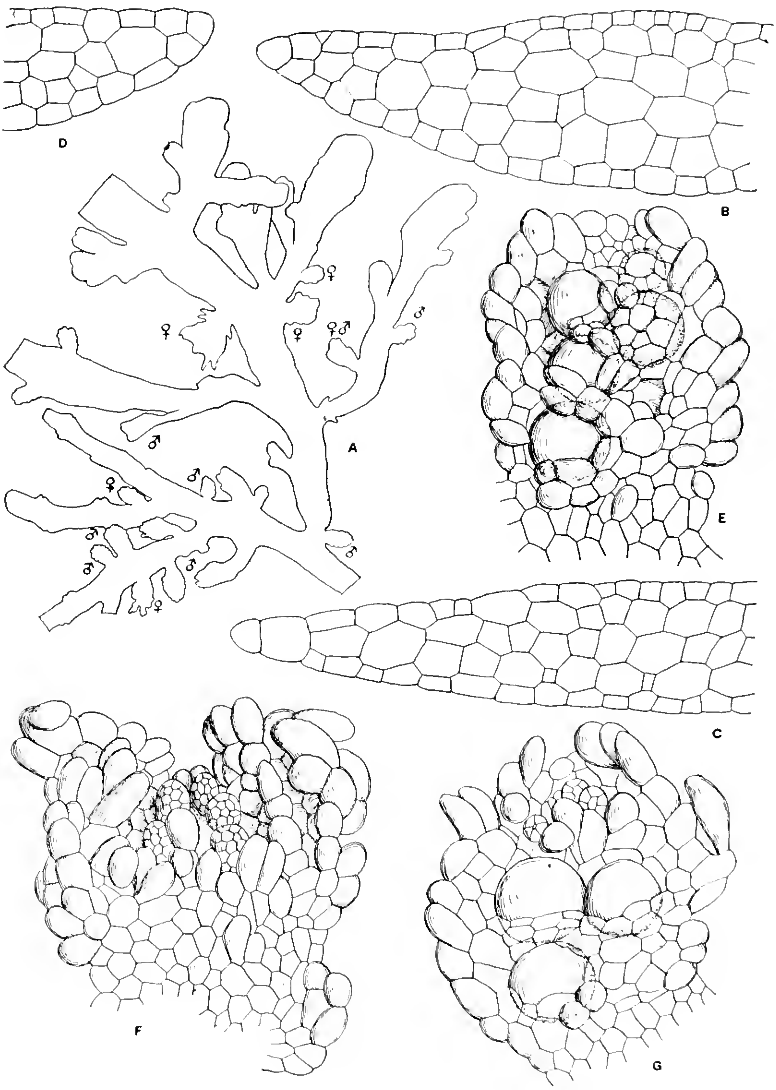

FIGURE 9. RICCARDIA DIVERSIFLORA Evans

A. Part of thallus with numerous male and female branches and one bisexual branch, x 5. B. Transverse section of axis, x 100. C. Transverse section of primary branch, x 100. D. Other end of section partly shown in C, x 100. E. Male inflorescence, x 50. F. Female inflorescence, x 50. G. Bisexual inflorescence, x 50. The figures were all drawn from the type material.

monly 1-2 cm. and 1-1.5 mm. wide (Fig. 8, C, and Fig. 9, A). In some cases it shows a tendency to broaden out gradually toward the apex, especially if the basal portion is narrow. It is strongly flattened, being plane or nearly so above, slightly convex below, and thinning out gradually toward the margins, where a single row of cells can be distinguished or, more rarely, two rows. The median portion is only 0.2-0.25 mm. thick, representing five or six layers of cells (Fig. 9, B). The surface-cells here average about 60 μ in length by 30 μ in width; toward the margin they gradually become larger, the cells of the marginal row being often 80-100 μ long and 40-50 μ wide. The interior cells are about 50 μ in width and 160-280 μ in length. There is thus a rather marked contrast in size between the surface-cells and the interior cells of the median portion when these are examined in cross section. The cell walls throughout are slightly but distinctly thickened, the thickening being especially marked in the marginal and superficial cells.

The primary branches (Fig. 8, C, and Fig. 9, A) show a tendency to be opposite and arise at intervals of 0.7-1 mm. on each side of the axis. The branches spread obliquely and often broaden out toward the apex. An occasional branch represents a new axis but the majority are quickly limited in growth. Branches of this character are mostly 3-5 mm. long and 0.5-1 mm. wide. The primary branches usually give rise to a very few secondary branches, which are 0.6-1.2 mm. long and 0.4-0.6 mm. wide. In some cases these secondary branches do not develop but remain as short and perhaps latent rudiments. Such a rudiment may be indented at the tip, with the apical cell in the indentation, or the apical cell may be in an indentation between the rudiment and the primary branch. Under these circumstances the rudiment looks like a short rounded lobe. Stolons are indefinite in position and only slightly differentiated, never approaching a terete condition. In their histological structure the branches are essentially like the main axis, except that they are slightly thinner and more frequently bordered by two rows of cells (Fig. 9, C, D).

The sexual branches are very short and arise either from the axis itself or from the base of a primary branch. In the latter case there are usually only one or two on each side. The following four types of inflorescence occur in the species, all four being sometimes present on an individual thallus (Fig. 8, C): male, female, bisexual with the antheridia at the base and the archegonia toward the apex, and bisexual with the sexual organs in the reverse position. In two instances proliferations of a female inflorescence have been observed. One was in the form of a second inflorescence; the other in the form of a long branch bearing two sexual branches and also sterile branches. A male inflorescence (FIG. 9, E) is about 1 mm. long and 0.6 mm. wide; it develops an obliquely spreading wing two or three cells wide and irregularly crenulate from projecting cells. As a rule only six to eight antheridia are present, and the openings of the antheridial chambers are separated by two rows of cells, some of which often project slightly above the average level. The partitions between the chambers are occasionally incomplete, and antheridia in consequence may be in contact with one another.

The female inflorescence (FIG. 9, F) is about as long as the male, but the wing is three to five cells wide and irregularly split up into short lobes or cilia, supplemented by similar but still shorter structures among the archegonia. From four to eight archegonia are usually developed. The bisexual inflorescences are no larger than the unisexual and combine their features, the abrupt change in the character of the wings being especially striking (FIG. 9, G). It is unfortunate that the "calyptra" and sporophyte of *R. diversiflora* are still unknown.

Bisexual branches in the genus *Riccardia* have already been demonstrated in two species: *R. androgyna* Schiffn. of Java (**20**, p. 44) and *R. insularis* Schiffn. of the antarctic islands St. Paul and New Amsterdam (**21**, p. 66, *pl. 6, f. 1-7*). In *R. androgyna* these branches bear antheridia at the base and archegonia above, while in *R. insularis* they bear archegonia at the base and antheridia above. In addition to the bisexual branches *R. androgyna* shows male branches only, while *R. insularis* shows both male and female. The presence of all four types of inflorescence in a single species is the most remarkable feature of *R. diversiflora*.

Even in its vegetative features *R. diversiflora* differs from *R. autoica* in several important particulars. It lacks, for example, the distinctive photosynthetic systems of *R. autoica*, in which the short branches are sometimes so crowded together that they overlap; and it lacks also the well-differentiated stolons, which are often if not invariably found in the older species. The lack of stolons is perhaps associated with the fact that the plants are not closely adherent to the substratum. The comparison of cross sections brings out certain differences in histological structure. It will at once be seen that the contrast in size between the superficial and interior cells is more marked in *R. diversiflora* than in *R. autoica*, owing mainly to the fact that its interior cells are considerably wider. In *R. autoica*, moreover, the wings of the thallus, especially on the ultimate branches, attain a greater width and are often distinctly crenulate, while in *R. diversiflora* the wings are less distinctive and usually entire or nearly so. It is in the sexual branches, however, that still more important differences can be made out, even if the bisexual branches of *R. diversiflora* are left out of consideration. In *R. autoica*, as seen by comparing Figs. 7, H, and 9, E, the smaller cells of the male inflorescence give the whole structure a more compact appearance. The suberect or connivent wings and the more complicated partitions between the chambers are likewise very distinctive. In the female inflorescence the archegonia of *R. autoica* are directed forward and the most conspicuous part of the branch is the lobe-like structure lying in the same plane as the higher axis, the actual wings of the inflorescence being reduced. In *R. diversiflora*, on the other hand, the archegonia are directed upward, no lobe-like structure is developed, and the wings of the inflorescence are well developed and expanded.

Another species with which *R. diversiflora* should be compared is *R. tenerrima*. The two plants are of about the same size, they branch in much the same way, they are both monoicous, and both show very similar histological features. *R. diversiflora,* however, is a firmer plant than *R. tenerrima;* rhizoids are far more sparingly produced; and the contrast in size between the superficial and interior axial cells is more marked. The sexual branches yield characters which are still more distinctive. In *R. diversiflora* bisexual branches are not uncommon; the male spikes are about 1 mm. long and 0.6 mm. broad, and the wing is two or three cells broad; the female branch is distinct and has numerous archegonia and broad lobate or ciliate wings. In *R. tenerrima* no bisexual branches have been observed; the male spikes are usually less than 0.5 mm. in length and only about 0.25 mm. in width, and the wing is only one cell wide; the female branches are reduced to very short lobes with only one or two archegonia and scarcely evident wings, the marginal cells projecting slightly or not at all.

18. **Riccardia Negeri** (Steph.) comb. nov.

Aneura Negeri Steph. Bull. Herb. Boissier 7: 747. 1899.

Specimens examined: without date or definite locality, southern Chile, *F. W. Neger 34* (B., type of *Aneura Negeri*). Known only from the type locality.

In describing his *Aneura Negeri* Stephani emphasizes the great uniformity which the thallus exhibits and its broadly rounded margins. A uniformity in structure and appearance implies that the characters of the plant are rather negative, but fortunately these negative features are supported by more positive peculiarities, when the histology of the thallus is taken into consideration. The scanty type material throws little light on the habit of the plant; it shows nothing of the way in which the thallus is attached to the substratum, and it gives but little information about the female inflorescence and none at all about the male. It is sufficient to show, however, that *R. Negeri* is amply distinct and without close relatives among the other Chilean species of the genus.

The plants, which are apparently loosely tufted and erect, are light to dark brown in color and firm and rigid in texture. Neither stolons nor rhizoids have been observed. The axis (Fig. 10, A) is usually 3-5 cm. long but may attain a length of 7 cm. according to Stephani. The width is mostly 1-1.5 mm. and the thickness about 0.3 mm. Except toward the thick rounded edges, wholly destitute of wings, the two surfaces are plane or nearly so, although the dorsal surface may show a slight convexity and the ventral surface a still slighter concavity. In the median portion the thallus is mostly ten to twelve cells thick, but toward the margin (owing to the greater size of the cells in this region) it is only about eight cells thick (Fig. 10, C). The cells of the outermost layer are about 14 μ wide and usually 30-50 μ long, although more nearly isodiametric cells are not infrequent. On the lower surface a broad median band of this layer is composed of unusually delicate and short-lived cells, which can be seen clearly only in the youngest part of the thallus. In the older parts vestiges of these ephemeral cells can usually be detected, but the second layer

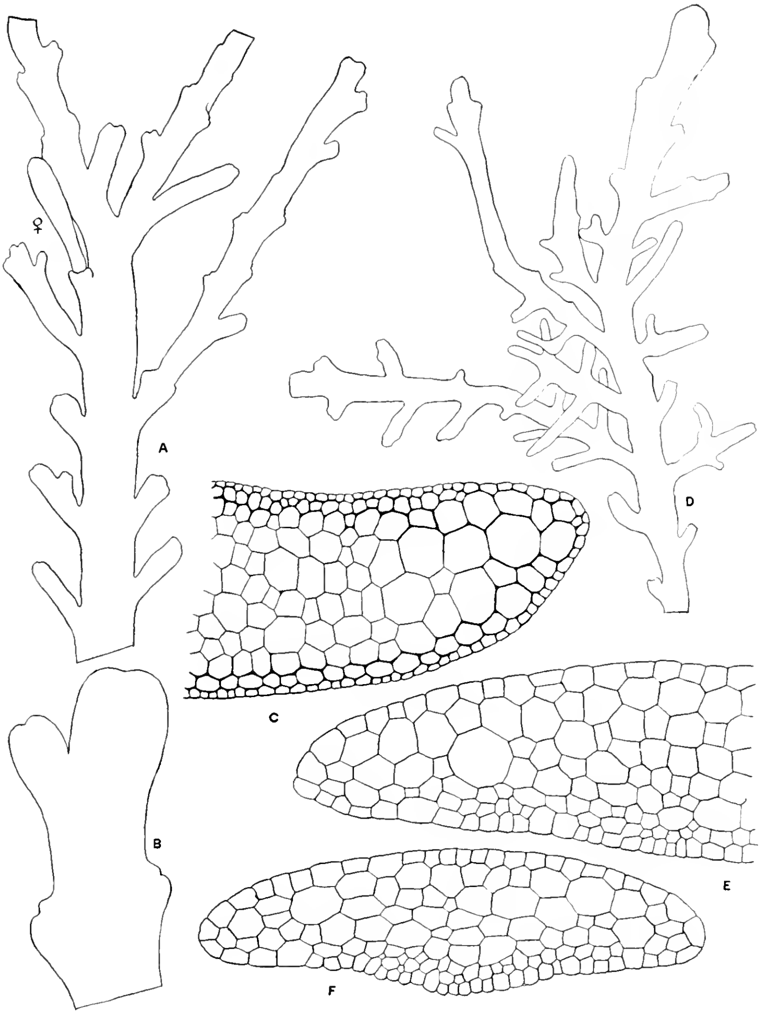

FIGURE 10

A-C. RICCARDIA NEGERI (Steph.) Evans

A. Part of thallus with one female branch, x 4. B. Tip of a vigorous branch, showing two branch-rudiments, x 25. C. Transverse section of axis, the ventral surface turned upward, x 100. The figures were all drawn from the type material of *Ancura Negeri.*

D-F. RICCARDIA MYCOPHORA Evans

D. Part of thallus, x 5. E. Transverse section of axis, x 100. F. Transverse section of ultimate branch, x 100. The figures were all drawn from the type material.

becomes the actual bounding layer and often appears continuous with the persistent part of the outermost layer. The cells of this second layer are only a trifle wider than those of the outermost layer, averaging about 16 μ. The interior cells are mostly 100-180 μ long; in the median portion they average about 30 μ in width, but toward the margins they are considerably wider, averaging about 45 μ. In cross-section the increase in the size of the cells in passing inward is fairly gradual, especially in the median portion. The interior cells are all thin-walled. The cells of the two or three outside layers, however, with the exception of the short-lived median band, have their walls slightly and uniformly thickened.

On each side of the axis, at intervals of 1-3 mm., branch-rudiments or branches are given off. The branch-rudiments (Fig. 10, B) are in the form of very short bilobed projections, with the apical cell in the indentation between the lobes. The branches spread obliquely and are mostly 0.7-1 mm. wide. Except for differences in length the branches are remarkably uniform and do not differ in any essential respect from the axis, so far as their histological features are concerned. Many of the branches, in fact, represent new axes and show long-continued growth, with numerous branch-rudiments and branches of their own. The majority, however, stop growing when they have attained a length of 1-3 mm. and these branches are either simple or show only one or two still shorter branches or branch-rudiments.

Stephani described his *Aneura Negeri* as sterile, but the material studied by the writer shows two female inflorescences, one of which has been fertilized (Fig. 10, A). The branch in each instance is very short and spreads obliquely from the main axis. It is fleshy and slightly bilobed at the apex, one of the lobes being partially covered over by the axis. The wings, which do not show very clearly, are apparently one cell wide and vaguely crenulate or denticulate from projecting cells. About four archegonia are present in the unfertilized inflorescence, and the other shows an old battered "calyptra", clavate in form, 4.5 mm. long and 0.75 mm. wide. The surface is roughened from peeling-off cells, and no sign of a corona is visible.

In its histological features *R. Negeri* bears a certain resemblance to *R. Spegazziniana* and *R. spectabilis*, with which Stephani associated it. All three species show one or more layers of small cells on the outside of the axis and a consequent contrast in size when these cells are compared with the larger cells of the interior. In *R. Spegazziniana* there is only one layer of small cells, and the contrast in size is very striking; in *R. spectabilis* there are two or three layers in the median portion of the axis, these cells are all persistent, and the contrast in size is less marked; in *R. Negeri* there is only one layer of small cells except for a broad median band on the lower surface, where there is a second short-lived layer on the outside, while the contrast in size is striking toward the margins but less so in the median portion. Both *R. Spegazziniana* and *R. spectabilis* are further distinguished by a regular pinnate branching, in which all (or nearly all) of the branches are limited in growth and clearly different from the axis, and by a complete lack of latent branch-rudiments in the older part of the thallus. In *R. Negeri* the branches vary in length but are otherwise essentially like the axis, and latent branch-rudiments are frequent.

19. **Riccardia mycophora** sp. nov.

Growing in thin depressed mats, pale brown (when dry) varying to dark brown: thallus apparently prostrate throughout, the axis strongly flattened but rounded on the edges and wholly destitute of wings, rather copiously branched; branches narrower than the axis but otherwise scarcely differentiated, often sparingly subdivided, the secondary branches rarely remaining in a rudimentary condition, usually similar to the primary branches and sometimes giving rise to one or two very short tertiary branches; axis and branches with a ventral median band of narrow cells containing fungus hyphae: remaining parts unknown.

Specimens examined: Mayne Harbor, Patagonia, 1888, Voyage of the "Albatross" (U. S., Y., listed by the writer as *Aneura multifida* (?), **8**, p. 141). Known only from the type locality.

The type material of *R. mycophora* is unfortunately sterile, but the thallus presents certain features which distinguish it clearly from *R. Negeri*, the species to which it is apparently most closely allied. The plants are pale to dark brown in color and grow in loose tufts in admixture with a second species of *Riccardia* too incomplete for determination. They seem to be prostrate in habit, but no stolons are present and rhizoids are very sparingly produced. The texture is fairly firm.

The axis shows a living portion which is usually 2-3 cm. in length, 0.8-1.5 mm. in width and 0.25-0.3 mm. in thickness (FIG. 10, D). The median portion is eight to ten cells thick, and the decrease in thickness toward the rounded margins is gradual and slight. Both surfaces are slightly convex (FIG. 10, E). On the ventral surface a broad median band composed of narrow cells, 80-160 μ long and only 20 μ wide, can be distinguished. These cells are crowded with fungus hyphae and constitute the most distinctive feature of the species. The remaining cells of the surface layer are mostly 60-80 μ long and 30 μ wide, and their cavities contain no hyphae; toward the sides of the thallus the surface-cells decrease somewhat in length, the marginal cells being about 40 μ long. The interior cells are mostly 150-200 μ long and 30-50 μ wide, but an occasional cell indefinite in position and considerably wider is sometimes present. Such a cell is shown at the left of the figure and may be as much as 80 μ wide. Sometimes the cells next to the fungus-bearing band of the ventral surface are narrow and bear hyphae also, but the other interior cells usually lack them completely. The cells throughout have slightly thickened walls.

Branches arise at intervals of 1-3 mm. on each side of the axis and spread obliquely. They are narrower than the axis, measuring usually 0.35-0.7 mm. in width, but are essentially the same in structure, the fungus-bearing band being distinct (FIG. 10, F). An occasional branch represents a new axis and exhibits indefinite growth, but most of the branches soon stop growing, although their length may vary from 2 mm. to 1 cm. Sometimes even a primary branch may be simple, but most of them bear from one to ten secondary branches; these in turn are usually simple but one or two very short tertiary branches are sometimes produced. The ultimate branches of whatever rank are mostly 2 mm. or less in length, 0.2-0.45 mm. in width and about 0.15 mm. in thickness. They show the same structure as the primary branches, the band of cells with hyphae being still a striking peculiarity, but the median portion is only six or seven cells thick. Branch-rudiments, which rarely persist in the older parts of the thallus, are in the form of very short bilobed projections, with the apical cell in the indentation.

A group of differentiated cells containing hyphae is a rare phenomenon in the Jungermanniales and will at once distinguish

R. mycophora from the other Chilean species of *Riccardia.* In separating it from *R. Negeri,* the more flaccid texture of the plant should be taken into consideration also, together with the more irregular branching. In *R. Negeri,* moreover, the large interior cells in the marginal portion of the thallus show conspicuously through the small-celled surface layer, but nothing comparable with these is present in *R. mycophora.*

20. **Riccardia nudimitra** (Steph.) comb. nov.

Aneura nudimitra Steph. Sp. Hepat. **6**: 35. 1917.

Specimens examined: Sholl Bay, Clarence Island, *Hariot 62* (B., type of *Aneura nudimitra*); Halt Bay, 1868, *Cunningham 162* (M.); near Mt. Richardson, Staten Island, 1882, *Spegazzini 73* (M.). No other localities have been reported.

Although a differentiation of the thallus into stolons, prostrate caudex, and ascending photosynthetic branch-systems is clearly indicated in *R. nudimitra,* these various kinds of axes are connected with one another by intermediate structures. The irregularity thus produced is supplemented by a marked irregularity in the branching. The latter feature perhaps indicates a certain relationship to such species as *R. tenax,* but the more immediate allies of *R. nudimitra* seem to be found in *R. alcicornis* and *R. fuscobrunnea.* The plants are pale brown or greenish brown, becoming almost black in the older parts, and grow in intricate depressed mats, sometimes mixed with other bryophytes. Rhizoids are scantily produced and seem to be largely if not wholly confined to the stolons.

The main axis (Fig. 11, A, B) is at first prostrate, although it usually turns an edge rather than a surface to the substratum. Sometimes the prostrate position is retained for a long period, but the apical portion usually curves upward after a while, gives rise to a photosynthetic system and has its growth brought to an end. The axis is firm and distinctly flattened, measuring usually 1-1.5 cm. in length, 0.4-0.7 mm. in width and 0.2-0.25 mm. in thickness. On the sides it thins out gradually to edges which vary from rounded to subacute. Sometimes there is no sign whatever of a wing; sometimes a narrow band along the edge is paler than the median portion and gives the appearance of a wing, but even

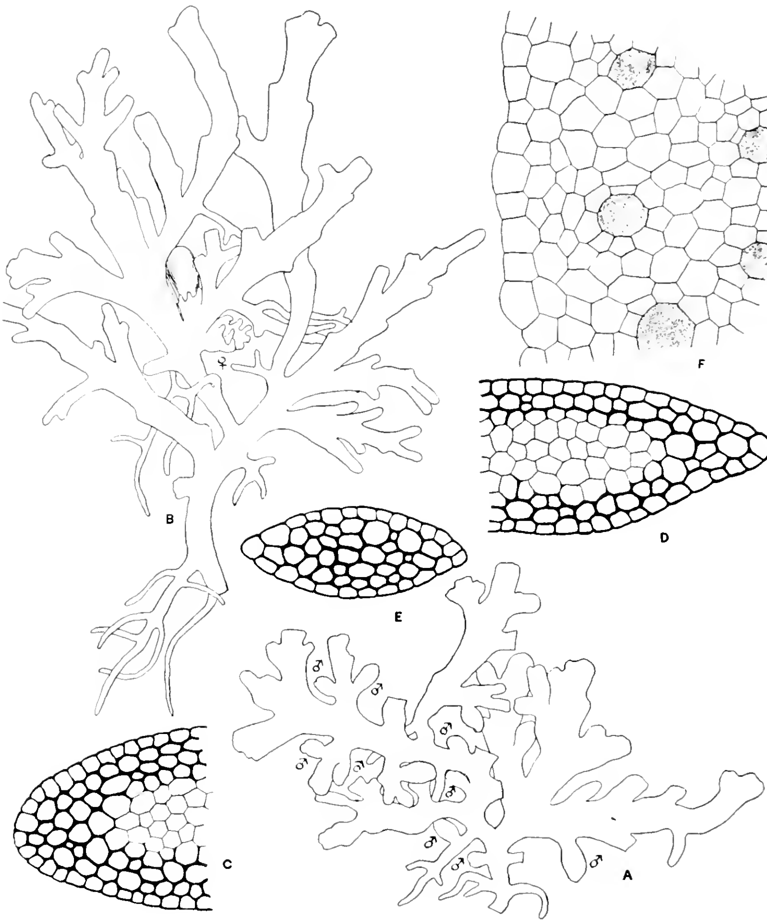

FIGURE 11. RICCARDIA NUDIMITRA (Steph.) Evans

A. Part of male thallus with numerous male branches, x 8. B. Part of female thallus with two female branches. C. Transverse section of axis, basal part, x 100. D. Transverse section of axis, upper part, x 100. E. Transverse section of ultimate branch, x 100. F. Part of large male inflorescence, x 100. A was drawn from the type material of *Aneura nudimitra;* B-F, from a specimen collected at Halt Bay by A. Cunningham.

under these circumstances the thallus is three or more cells thick except on the very edge, where an indistinct and interrupted row of cells can be distinguished. In cross section (FIG. 11, C, D) the axis is biconvex in outline, the median portion being usually ten to twelve cells thick. The surface-cells average about 20 μ in width and 30 μ in length; toward the margin a gradual increase in size is usually apparent and some of the marginal cells are 30 μ wide. In the median portion the cells become gradually larger toward the middle, the innermost cells averaging about 25 μ in width and usually measuring 80-150 μ in length. In the marginal portions, especially if these are pale and translucent, the contrast in size between the superficial and interior cells is more abrupt. The walls of the surface layer are thickened but pale; the walls of the next two or three layers are still more thickened and are usually more or less deeply pigmented; the walls of the interior part of the axis are thin and pale or colorless. There is thus formed a narrow sclerotic zone around a delicate central core, but the boundaries of the zone are poorly defined toward the sides, especially in the more flattened axes.

At intervals of perhaps 0.5-1.5 mm. on each side the axis gives off branches, which are exceedingly variable. The most characteristic are those which develop into ascending or suberect branch-systems, photosynthetic in character and quickly limited in their growth. Even these, on account of their irregularity, are difficult to describe in a few words. They are mostly 5-10 mm. long and may be as wide or even a little wider than the main axis, often showing a tendency to broaden from a narrow base. They are usually more strongly flattened than the main axis, the median portion being perhaps eight cells thick. At close intervals (mostly 1.5 mm. or less) the primary photosynthetic branches bear branch-rudiments or branches. The branch-rudiments vary in number and are usually in the form of short rounded lobes with the apical cell in the axil. The secondary branches are usually shorter and narrower than the primary branch but may almost equal it in length; they give rise in turn to tertiary branches (or branch-rudiments) and these sometimes bear branches or branch-rudiments of a lower order. Although most of the primary branches and many of the secondary branches are broad at the apex, others become narrower, their tips thus resembling branches of a higher order. Even the primary axis, if it gives rise directly to a photosynthetic system, may taper toward the apex. The ultimate branches and the narrow extremities of axes of higher rank are mostly 0.25-0.3 mm. wide. Stolons are frequent and may arise directly from the main axis or from the base of a primary, secondary or even tertiary branch. They are in the form of slender and often irregularly branched, terete or subterete structures, with a diameter of 0.1-0.2 mm. The structure of the photosynthetic branches is much the same as that of the axis, except that in the ultimate branches the central core of thin-walled cells may be lacking (Fig. 11, E). In the stolons, the sclerotic layer is very vaguely indicated, none of the cell-walls being much thickened.

The male branches are simple and often numerous. They arise singly, rarely from the main axis, more frequently from a primary branch, but usually from a secondary or tertiary branch (Fig. 11, A). Occasionally a pinnate arrangement of the male branches is distinguishable. The inflorescence (Fig. 11, F) occupies nearly the whole length of the branch, and no cases of proliferation have been observed. The inflorescence is mostly 0.5-1.5 mm. in length and 0.35-0.45 mm. in length. The wings, which are one or two cells wide, are spreading, erect or connivent, and the margin is entire or vaguely crenulate from an occasional projecting cell. The antheridia are mostly from four to twenty, and the openings between the chambers are separated by from three to five cells, numbers which are unusually high.

The female branches (Fig. 11, B) are simple and very short. They arise singly or in subopposite pairs, sometimes on the main axis itself but usually on a primary or secondary branch. The wing is deeply and irregularly lobed, the lobes being mostly three to five cells long, acute to obtuse or rounded, and more or less crenulate. The archegonia are very few but could not be counted clearly in the specimens studied by the writer. The only "calyptras" seen were immature. In this condition they are perfectly smooth and are tipped by a distinct corona, shortly and bluntly conical at the apex.

In spite of its irregularity *R. nudimitra* resembles *R. alcicornis* in several respects. The two species are of about the same size and are both firm in texture; they both show a tendency to become very dark with age and to develop a purplish black pigmentation in certain of the cells; and both are wingless or nearly so throughout, although a marginal row of cells is sometimes distinguishable. The lack of stolons and the fairly regular pinnate branching in *R. alcicornis* will at once distinguish it from *R. nudimitra*. There are likewise histological differences. The cells of *R. alcicornis,* for example, are unusually small, the surface-cells averaging only 12 μ in width and the interior cells only 17 μ; and the wall-thickening in the second and third layers is very slight: in *R. nudimitra* the cells are somewhat larger, the surface cells averaging about 20 μ in width and the interior cells about 25 μ; and the wall-thickening in the layers inside the surface-layer is usually very pronounced. The resemblance of *R. nudimitra* to *R. fuscobrunnea* is still greater, the latter species being much more irregular in its branching than *R. alcicornis*. In *R. fuscobrunnea,* however, the cells are larger than in *R. nudimitra,* the surface-cells being usually 22-30 μ in width and the interior cells about 35 μ. There is, moreover, no distinct sclerotic zone, although all the cell walls tend to be somewhat thickened.

It has already been noted (see p. 100) that Stephani recorded his *Aneura stolonifera* from Chile in 1899. This species was first described and figured from Australian material collected by Kirton at "Illawarra" in New South Wales (**24**, p. 129, *pl. 3, f. 1*). A few years later Stephani proposed, as a new species, *A. striolata* from New Zealand, based on one of Colenso's specimens (**25**, p. 265, *pl. 26, f. 1-3*). When he revised the genus *Aneura* in 1899, he cited *A. striolata* as a synonym of *A. stolonifera* and reported it from the following additional localities: Queensland, *Walker;* "Fret. Magellan.," *Cunningham;* Java, collector unknown; Luzon, *Sempler*. The wide geographical distribution thus indicated arouses the suspicion that he may have understood the species in too broad a sense, and this suspicion is increased by some of his critical remarks. In distinguishing the species he lays especial stress on a peculiar lamellation of the cuticle, which he describes as "dense minuteque lamellifera." His figure of *A. striolata* shows the lamellae clearly in the form of crowded transverse bands, appearing along the edge of the thallus as minute denticulations. Largely on the basis of this character he refers the Queensland specimens to *A. stolonifera,* although he admits that the internal cells are smaller than in the type from Illawarra and that the thallus is noticeably shorter and more robust. These striking differences he attributes to environmental factors and intimates that too much emphasis has been laid on differences in the size of the cells in distinguishing species of *Aneura*. Unfortunately he tells us nothing specific about the other specimens which he cites. This is especially to be regretted in the case of the plant from Java, since Schiffner does not accredit *A. stolonifera* to Java at all and since he does accredit to the island, under the name *Riccardia scabra* Schiffn., another species with a lamellated cuticle (**20**, p. 41). The question at once arises, is Stephani's "*A. stolonifera*" from Java the same as *R. scabra?* Apparently not, since Stephani admits the validity of *R. scabra*, describing the cuticle as "aspera"; and yet this, and similar questions regarding the specimens from Chile and Luzon could be definitely answered only by the careful study of the specimens in the Stephani Herbarium.

In order to throw some light if possible on the specimens cited under *A. stolonifera* from the Straits of Magellan, the writer has examined the series of Cunningham's *Riccardiae* in the Mitten Herbarium. Unfortunately there is nothing labelled "*A. stolonifera*", and the specimens which come closest to Stephani's description are those listed above under *R. nudimitra*. These specimens agree in their irregular branching and numerous stolons and in their lack of true wings. The cuticle, however, is perfectly smooth, and the difference in size between the superficial and interior cells is much less marked than in Stephani's figure of *A. striolata*. In spite of these differences the writer is inclined to believe that these specimens formed the basis for Stephani's record and would suggest that *A. stolonifera* be omitted from the list of Chilean species, until its presence has been more definitely established.

21. **Riccardia floribunda** (Steph.) comb. nov.

Aneura floribunda Steph. Bull. Herb. Boissier **7**: 749. 1899.
Aneura profunda Steph. Kungl. Svenska Vet.-Akad. Handl. **46**^{9}: 8. *f. 1, c.* 1911.

Specimens examined: on rotten logs, Puerto Angosto, Desolation Island, 1896, *Dusén 261* (N. Y., U., listed by Stephani as *Aneura floribunda*, **29**, p. 8); Hale Cove, Hale Island, 1908, *Skottsberg 32* (U., labelled *A. profunda* and listed under this name by Skottsberg, **22**, p. 8); "ex loc. natali," 1908, *Scottsberg* (B., labelled *A. profunda*); Port Gallant, *Cunningham 157* in part (M.); Island Harbor, *Cunningham 45* (M.); Staten Island, 1882, *Spegazzini 39, 44* (M., apparently listed as *R. pinnatifida*, **16**, p. 254).

The following additional stations for *Aneura floribunda* are given in Stephani's papers: Punta Arenas, *Dusén* (**29**, p. 8); Clarence Island, *Racovitza 178d, 187c* (**30**, p. 4); Hale and Atalaya Islands, Puerto Gray, Skyring, Otway Bay, Canal Inocentes, Canal Inga, *Skottsberg* (**32**, p. 7, and **22**, p. 50, etc.). There are likewise two reports from the Falkand Islands (**31**, p. 2, and **32**, p. 7).

There are several important characters of *R. floribunda* which the material at hand does not show very clearly. It is impossible to determine, for example, how the young plants attach themselves to the substratum. The specimens examined are all mature and show a densely tufted habit, the plants being apparently erect and wholly destitute of rhizoids. Some are in pure colonies, while others occur in admixture. The color is a dull green, more or less tinged with yellow or brown and often becoming a dark brown with age.

The living part of the axis (Fig. 12, A, B), which shows long-continued growth, is mostly 1.5-2.5 cm. in length; the width is 0.7-1.2 mm. and the thickness about 0.5 mm. in the wider specimens. The upper surface (Fig. 12, D) is plane or slightly concave, while the lower surface is somewhat convex. Toward the sides the axis thins out slightly but the edges are rounded and there is no indication whatever of wings. In the median portion the axis is mostly eight to ten cells thick. The surface-cells, which form a uniform layer over the entire structure, average about 45 μ in length and 32 μ in width. Between these and the interior cells the change in size is very abrupt, the latter measuring 160-220 μ in length by about 75 μ in width. The cell-walls are everywhere slightly but uniformly thickened, and the outer walls of the surface-cells are either plane or very slightly bulging.

The branching of the axis (Fig. 12, A, B) is exceedingly irregular. The branch-rudiments or branches occur at intervals of 0.5-2.5 mm. on each side. The branch-rudiments (Fig. 12, C), which are more frequent than in *R. diversiflora*, are in the form of short, deeply indented lobes with the apical cell at the bottom of the

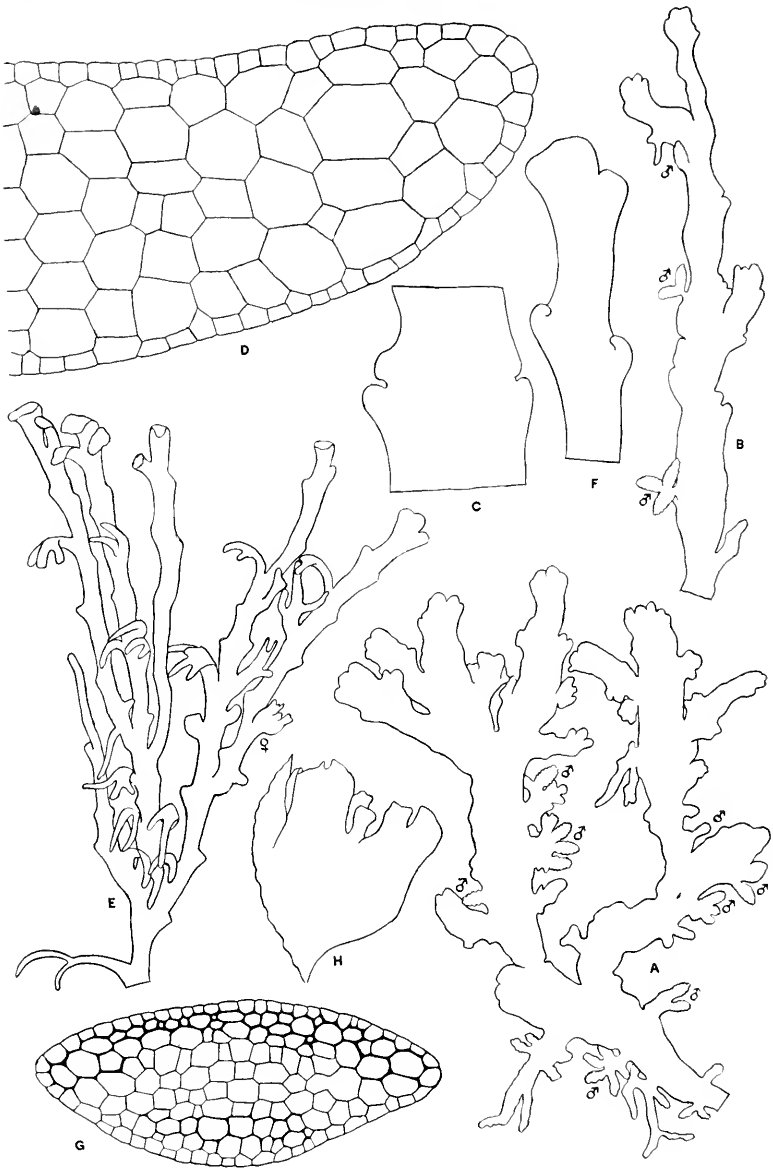

FIGURE 12

A-D. RICCARDIA FLORIBUNDA (Steph.) Evans

A, B. Parts of male thalli with numerous male branches, x 5. C. Two branch-rudiments, x 25. D. Transverse section of axis, x 100. The figures were all drawn from a specimen of *Aneura floribunda* collected on Desolation Island by P. Dusén, No. 261.

E-H. RICCARDIA TENAX (Steph.) Evans

E. Part of thallus, x 5. F. Apex of a vigorous branch showing two branch-rudiments, ventral view, x 25. G. Transverse section of axis, x 100. The figures were all drawn from a specimen of *Aneura tenax* collected on Desolation Island by P. Dusén, No. 195.

indentation. The developed vegetative branches vary greatly. Some of them are suberect or obliquely spreading and essentially like the axis, approaching or even equaling it in width and showing long-continued growth. Others are shorter and quickly limited in their growth. These shorter branches rarely exceed 5 mm. in length and are mostly 0.2-0.6 mm. broad. They may be simple or sparingly subdivided, and their branches or even their apices are sometimes in the form of stolons, directed more or less backward. The stolons are perhaps 0.3 mm. wide and 0.18 mm. thick. Although the cells are smaller than those of the axis, there is still a sharp contrast in size between those of the interior and those of the surface layer. An average stolon is four or five cells thick.

The male branches, which are abundantly produced (Fig. 12, A, B), are very short and arise directly from the main axis or one of the axial branches. Some of the branches are simple and occupied by a single inflorescence; others become at once subdivided into from two to six divaricate branches, most or all of which are occupied by inflorescences. An individual inflorescence is mostly 0.4-0.6 mm. long and about 0.3 mm. wide. The narrow wing, usually a single cell in width, spreads obliquely and is more or less crenulate from projecting cells. The antheridia usually number from six to eight and the openings into the antheridial chambers are separated by one or two rows of cells, some of which bulge slightly. No female plants have been seen by the writer. Stephani states that the short female branches are papulose along the margin and borne singly at the base of pinnae; and that the "calyptra" is very long, coarsely cellular-verrucose, and tipped by a small corona.

The present species occupies a somewhat isolated position among the Chilean representatives of *Riccardia*. It is about as large as *R. diversiflora* and agrees with it in branching irregularly. Except for these superficial resemblances, however, the two species have but few features in common, and the differences between them are striking. In *R. floribunda,* for example, the inflorescence is dioicous, the edges of the thallus are rounded, the interior cells have an average width of about 75 μ, and the branching seems to be absolutely indefinite; in *R. diversiflora*, on the contrary, the inflorescence is monoicous, the edges of the thallus are thin and sometimes indistinctly winged, the interior cells have an average width of only 50 μ, and the branching in spite of its irregularity does conform more or less to a certain scheme. The large interior cells of *R. floribunda* are sometimes clearly visible through the small-celled superficial layer, and in this respect recall the appearance presented by *R. Spegazziniana,* where the interior cells toward the margin often surpass those of *R. floribunda* in size. Here again the resemblance hardly signifies relationship. The thallus of *R. Spegazziniana* is at once distinguished by its greater size and regular pinnate branching, the short branches becoming more or less subdivided in a definite manner.

The inclusion of *Aneura profunda* among the synonyms of *R. floribunda* is not wholly justified. The species was based on material collected by Halle at Melinca, Guaitecas Islands, and was described as sterile. Halle's specimens have not been seen by the writer and his opinion of *A. profunda* is derived from the plants collected by Skottsberg and received from Upsala and the Boissier Herbarium. These plants clearly represent *R. floribunda* and agree in a general way with Stephani's very brief description of *A. profunda,* except that the contrast in size between the superficial and interior cells is less marked than his measurements would indicate. According to his data the surface-cells are 18 μ in width and the interior cells 108 μ, while the writer's measurements are 32 μ and 75 μ, respectively. Unfortunately Stephani's figure of *A. profunda,* which represents the cross section of a primary branch, does not support his description. It shows surface-cells which equal or even surpass the interior cells in size and which (according to his scale of magnification) have an average width of about 67 μ. In view of the conflicting evidence it seems best to reduce *A. profunda* to synonymy, at least provisionally, but to recognize the possibility of its restoration to specific rank in the future.

22. **Riccardia tenax** (Steph.) comb. nov.

Aneura tenax Steph. Bull. Herb. Boissier 7: 755. 1899.

Specimens examined: Puerto Angosto, Desolation Island, 1896, *Dusén 195* (U., labelled *Aneura tenax* and listed under this name by Stephani, **29**, p. 9).

The following additional records under *Aneura tenax* may be cited from the literature: Port Cook, Staten Island, *Skottsberg*, and Ushuaia and Tekenika Bay, Tierra del Fuego, *Skottsberg* (**31**, p. 2).

In *R. tenax* another species of doubtful relationship presents itself. Here again, in the absence of young plants, the method of attachment to the substratum can not be determined. The specimens available are densely tufted, the individual thalli apparently maintaining an erect position, and the plants are unusually stiff and unyielding to pressure. The younger parts of the plants are brownish or yellowish green, but the older parts are much darker and even appear blackish when dry. No rhizoids have been seen.

The main axis, so far as one can be distinguished (FIG. 12, E), shows a more or less decurved apex and long-continued growth, a length of 1-2 cm. being reached. The width usually varies between 0.4 mm. and 0.6 mm., and the thickness between 0.25 mm. and 0.3 mm. In the apical portion the flattening is somewhat more pronounced than in the basal portion. Both surfaces are somewhat convex, the ventral tending to be a little more so than the dorsal, and there is a gradual thinning out to the edges, which are rounded below and subacute above. The cross section (FIG. 12, G) shows that the axis is nine or ten cells thick in the median portion. The surface-cells average about 35 x 18 μ, and the innermost cells meassure 70-120 μ in length by about 35 μ in width; the increase in size in passing inward is gradual. The second and third layers of cells from the outside have thickened and sometimes pigmented walls. The other cells have thin and either colorless or very pale walls. The margin itself, in the flatter part of the axis, may be bounded by a more or less distinct row of cells, although nothing definite enough to be called a wing is differentiated.

At intervals of 1-2 mm. on each side of the axis branches or branch-rudiments can be observed (FIG. 12, E). The latter are about as numerous as the branches, and each one shows a blunt lobe arching over the apical cell, which is situated in the angle between the lobe and axis. The tip of the lobe lies under the axis and is visible only from below (FIG. 12, F). Of the vegetative branches which develop three types can be distinguished: leading suberect branches essentially like the axis, flattened branches directed obliquely forward, and subterete branches directed backward. The suberect branches are abundantly produced, and FIG. 12, E, shows the difficulty of distinguishing between the axis and branches of this character. The obliquely spreading branches are soon limited in growth, the best-developed being mostly

1-1.5 mm. long and 0.2-0.3 mm. wide. They are sometimes simple and sometimes give rise to one or two shorter and narrower secondary branches. The tips of the obliquely spreading branches and their subdivisions are decurved and not infrequently grow out into subterete extensions or stolons. They thus form a sort of connecting link between the typical obliquely spreading branches and the true stolons, which grow backwards almost from the beginning. These stolons, although limited in growth, are sometimes longer than the branches just described and may be simple or sparingly branched. In their histological features the branches with limited growth are much like the axis, except that the walls are pretty uniformly thin. There is also, especially in the stolons, less difference in size between the superficial and interior cells, the latter averaging only 25 μ in width. A typical stolon is about fifteen cells wide and twelve thick.

No male plants have been seen by the writer, but Stephani gives a full description of the male branches. These are as wide as the axis and are borne singly, sometimes on the axis itself, sometimes on a flattened branch, sometimes on a stolon, and a regularly pinnate arrangement may be present. The inflorescence is deeply bilobed at the apex, canaliculate above, and bordered by erect, foliaceous, papulose-crenate wings. The antheridia number ten or less. The female branches studied by the writer are very short and arise directly from the axis or a leading branch (Fig. 12, E, H). The wings are mostly eight or ten cells wide and deeply divided into a few irregular lobes, which are mostly blunt and vaguely crenulate from projecting cells. The archegonia are directed forward and no more than four have been observed in any inflorescence. The "calyptra", according to Stephani, is cylindrical, papulose, and tipped by a small obtuse corona.

Although *R. tenax* is about as irregular in its branching as *R. floribunda* and agrees with it further in the possession of numerous latent branch-rudiments, the two species are totally unlike in most other respects. This is seen with especial clearness when their histological features are compared. In *R. tenax* there is a gradual increase in the size of the cells in passing inward, the innermost cells averaging only 35 μ in width; while in *R. floribunda* the contrast in size between the superficial and interior cells is very striking, the latter averaging 75 μ in width. The difference in the branch-rudiments should likewise be emphasized. In *R. tenax* each rudiment shows a single lobe with the apical cell in its axil; in *R. floribunda* the rudiment is a bilobed projection with the apical cell in the indentation between the lobes. In its histological structure *R. tenax* approches more closely such species as *R. alcicornis* and *R. fuscobrunnea,* but these are both characterized by a fairly regular pinnate branching, in which branch-rudiments are absent altogether or very rare in the older parts of the thallus.

Another species with which *R. tenax* should be compared is *R. nudimitra.* The histological features of both plants have much in common, the branching is irregular in both, and the latent branch-rudiments in both are in the form of short lobes with the apical cell in the axil. The habit of *R. nudimitra,* however, is entirely different from that of *R. tenax.* It develops a prostrate caudex from which the photosynthetic branch-systems are given off, and in this way low depressed mats are formed. *R. nudimitra* is further distinguished by its shorter branch-rudiments, the apices of which are not concealed by the axis, and by its smooth "calyptra."

23. **Riccardia pallidevirens** (Steph.) comb. nov.

Aneura pallidevirens Steph. Bull. Herb. Boissier 7: 762. 1899.

Specimens examined: Puerto Angosto, Desolation Island, 1896, *Dusén 171, 189* (N. Y., U., cited by Stephani as *Aneura pallidevirens*, 29, p. 9).

The species has been reported by Stephani, under the name *Aneura pallidevirens,* from the following additional localities: Huafo Island, Almirantazgo and Lake Fagnano, Tierra del Fuego, *Skottsberg* (32, p. 7).

In his monograph of the genus Stephani places *A. pallidevirens* immediately before *A. pinguis* (L.) Dumort., thus emphasizing the slight morphological differentiation of the thallus. The plants are pale green and grow in depressed mats among other bryophytes, the thalli being loosely attached to the substratum by means of scattered rhizoids or else wholly free. In spite of their fairly large size the plants are delicate in texture.

The main axis (Fig. 13, A) is prostrate or perhaps ascending in the apical portion and grows indefinitely. The living portion is mostly 2-3 cm. long and 2-3 mm. wide, thus exceeding in width all the preceding species with the possible exception of *R. Spegazziniana*. The thickness, however, is only about 0.15 mm. Both surfaces are plane or nearly so (Fig. 13, B) and the rounded margins (Fig. 13, C) are only slightly thinner than the median region. According to Stephani the thallus is everywhere four cells thick, and this is true for the greater part of its extent, but the median portion is usually five cells thick and the marginal portion only three. In older parts of the thallus, moreover, the cells of the surface layer are often divided by delicate periclinal walls, so that under these circumstances the thallus becomes four to six cells thick. The cells of the surface layer, taking it in its whole extent, measure 80-120 μ in length by 20-30 μ in width, while the interior cells are mostly 100-140 μ long and about 40 μ wide. The cross section, therefore, shows a rather marked contrast in size when the superficial and interior cells are compared. The cells of the dorsal surface layer have bulging and thickened outer walls, the thickenings extending down the vertical walls and gradually thinning out. The cells of the ventral layer have slightly thickened and almost plane walls. Otherwise the walls are thin throughout.

Along the edges of the axis, at intervals of 1-3 mm. on each side (Fig. 12, A) branch-rudiments or branches are produced. The branch-rudiments are in the form of short bilobed projections with the apical cells in the indentations between the lobes. Most of the branches are short and blunt, showing one or more apical cells in shallow indentations. An occasional branch, however, shows unlimited growth and is essentially like the main axis, although tending to be a little narrower. The branches lie in the same plane as the axis and none are differentiated as stolons. As a rule the marginal cells of the thallus are not differentiated, but sometimes on a short branch a distinct row of hyaline marginal cells can be distinguished, especially in the vicinity of apical cells.

Only the female plant of *R. pallidevirens* is known at the present time. The female branches (Fig. 13, A) arise without regularity either on the main axis or on an axis-like branch. They are very short and at first resemble ordinary branch-rudiments, consisting of two rounded lobes with one or two archegonia between them, the lobes being confluent ventrally but separated dorsally. When well developed the lobes grow out into a shallow cup, open dorsally,

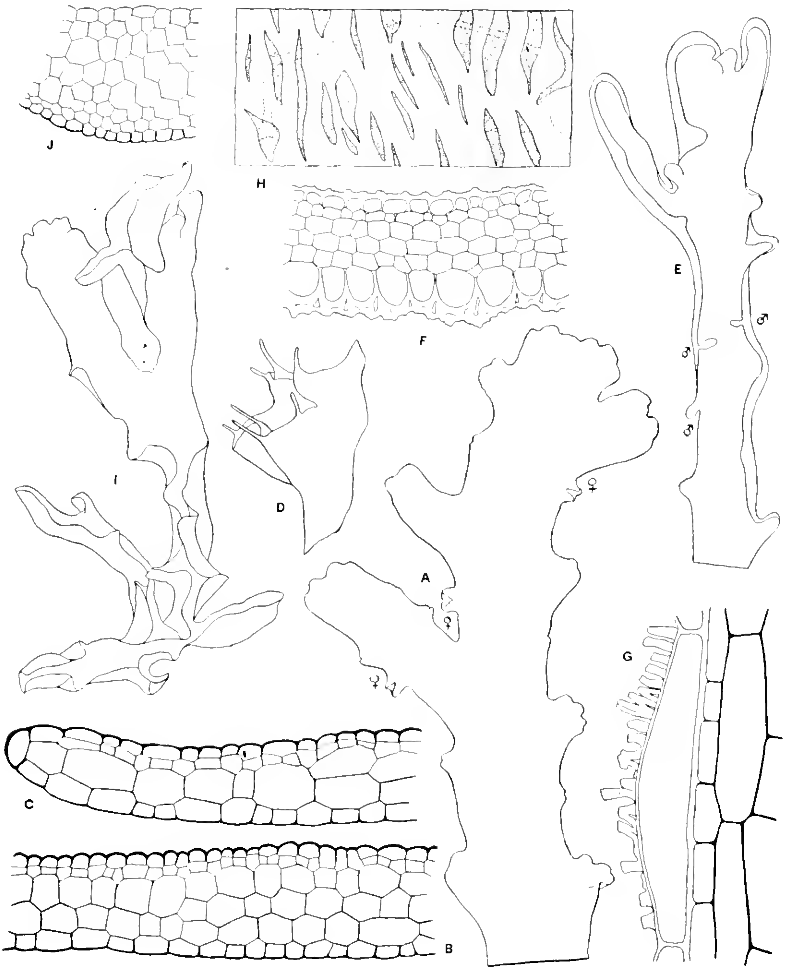

FIGURE 13

A-D. RICCARDIA PALLIDEVIRENS (Steph.) Evans

A. Part of female thallus with three female branches, x 4. B. Transverse section of thallus, median part, x 100. C. Transverse section of thallus, marginal portion, x 100. D. Female branch, x 40. The figures were all drawn from the type material of *Aneura pallidevirens*.

E-H. RICCARDIA GRANULATA (Steph.) Evans

E. Part of thallus, x 5. F. Transverse section of thallus, median portion, x 100. G. Cells of three ventral layers, longitudinal section, x 225. H. Cell of ventral surface layer, surface view, x 300. The figures were all drawn from a specimen collected on Staten Island by C. Spegazzini, No. 17.

I, J. RICCARDIA CRASSICRISPA (Steph.) Evans

I. Part of thallus, x 8. J. Transverse section of thallus, median portion, x 100. The figures were both drawn from the type material of *Aneura crassicrispa*.

and bordered by an entire but crispate wing about three cells wide. Along and near the margin of the wing scattered unicellular cilia (FIG. 13, D) make their appearance and strongly resemble rhizoids. In these fully developed inflorescences as many as four archegonia are sometimes present. The cilia just mentioned are not alluded to in Stephani's description and are certainly absent from young female branches. Whether they represent a constant or inconstant feature of a mature branch can not be decided from the material studied. It is unfortunate that the "calyptras" and sporophytes of this very distinct species are still unknown.

The tendency of the dorsal surface-cells of *R. pallidevirens* to divide by periclinal walls is a very interesting phenomenon. It represents a rudimentary type of secondary growth in thickness. According to Stephani (**25**, p. 26) secondary growth in thickness occurs in the robust axes of certain species of the genus, but the writer has seen nothing to support this view in any of the large Chilean species, such as *R. fuegiensis* or *R. prehensilis*. These species certainly do not develop a zone of meristematic cells, and it is difficult to see how continued growth in thickness could be brought about by any other means. It is to be regretted that Stephani did not enter into the subject more fully.

24. **Riccardia granulata** (Steph.) comb. nov.

Aneura granulata Steph. Hedwigia **32**: 21. 1893.

SPECIMENS EXAMINED: on banks of streams, Port Cook, Staten Island, 1882, *Spegazzini 17* (Massal., M., type of *Aneura granulata*); Cape Horn, *Hooker* (M., as *Aneura pinguis*); top of Cape Spencer, *Hooker* (M.).

According to Stephani *Aneura granulata* has been found also in the vicinity of Punta Arenas, *Skottsberg*, and on the Falkland Islands (**32**, p. 7).

In habit and general appearance *R. granulata* looks as if it might be a small form of *R. pinguis,* and it is not surprising that Hooker and Taylor confused the two plants. In its histological features, however, it is amply distinct, not only from *R. pinguis* and the somewhat similar *R. pallidevirens*, but from all the other known members of the genus. The plants are brownish green, at least when dry, and grow in thin mats or tufts. When soaked in water the dried specimens do not readily regain their original condition, even if the water is boiled, but treatment with caustic potash gives more satisfactory preparations. At the same time the study of fresh or carefully preserved material is much to be desired.

The thallus is prostrate or perhaps ascending, and the main axis is sparingly and irregularly branched (FIG. 13, E). The vegetative branches are essentially like the axis, except that they are often narrower, but in many cases their growth is limited while they are still very short. The main axis with its unlimited growth is usually 1-2.5 cm. long, 1-2 mm. wide (3-4 mm. according to Stephani), and 0.1-0.15 mm. thick. The median portion (FIG. 13, F) is usually six or seven cells thick and the rounded edges are scarcely thinner. These edges are frequently more or less involute, giving the upper surface a canaliculate appearance. No indication of a wing is ever present. At the apex the involute edges become continuous and form a cucullate apical pocket, in which a cluster of ventral papillae with thickened walls can be distinguished. In the older parts of the thallus groups of rhizoids, many of which are branched at the tips, are sometimes present and seem to be largely confined to the vicinity of the margins.

The most remarkable structural features of the thallus are found in the cells of the superficial layer. On the upper surface these cells are mostly 120-160 μ long and average about 25 μ in width, while on the lower surface they are of about the same length but considerably broader, averaging about 40 μ in width. Their walls are all thickened but on the free walls the thickenings are in the form of irregular truncate projections (FIG. 13, G), sometimes in the form of transverse, anastomosing bands (FIG. 13, H) but usually far more indefinite. These thickenings are laid down close to the growing point in the form of a continuous layer, which on the ventral surface soon becomes several times thicker than the cavities of the young cells. The layer soon attains its full thickness and extent and, when the cells grow to their full size, becomes ruptured in all directions, the transverse breaks being perhaps the most numerous. In this way the irregular projections described above are formed. Since these are lower than the thickenings on the younger cells, it is evident that their tips easily become broken off. On the dorsal surface the thickenings are much less conspicuous than on the ventral surface. When the margins of the thallus are involute, so that the ventral surface is seen in profile, the projections give the appearance of irregular solid teeth, these being especially conspicuous at the cucullate apex. The thickenings have a glassy aspect but their chemical composition has not been investigated.

The interior cells of the thallus are all thin-walled. Those forming the layer just inside the ventral surface layer are almost isodiametric, averaging about $28 \times 25\,\mu$; those just inside the dorsal layer are a little narrower, averaging about $18\,\mu$ in width; the remaining cells are about as long as the surface-cells and average $25\,\mu$ in width. In cross section, therefore, an abrupt difference in size is apparent when the cells of the ventral surface layer are compared with the others.

In the material studied by the writer a few male inflorescences are present. They arise directly from the axis and measure about 0.45 mm. in length by 0.3 mm. in width. The antheridia number about six, but the other features of the inflorescence are indistinct, owing to the densely crowded projections of the surface-cells. The female inflorescence is still unknown.

When Stephani first described this peculiar species he stated that the surface was roughened by unequal hyaline cells or by small conical multicellular lamellae. He compared these structures with the outgrowths found in *R. spinulifera,* in which a cellular condition is actually present. As a matter of fact the outgrowths of *R. granulata* are more comparable with the transverse bands of thickening found in *R. scabra* and *A. stolonifera,* since they represent nothing more than extreme modifications of the cell-wall. Stephani states further that the thallus is only four cells thick, but the writer suspects that his sections may have been cut from more or less collapsed material.

25. **Riccardia crassicrispa** (Steph.) comb. nov.

Aneura crassicrispa Steph. Kungl. Svenska Vet.-Akad. Handl. **49**[9]: 6. *f. l, c.* 1911.

Specimens examined: near the mouth of the Rio Fontaine, Tierra del Fuego, 1908, *Halle & Skottsberg 70* (U., type of *Aneura crassicrispa*). Known only from the type locality.

The plants of this species are fleshy and pale green, turning yellowish or brownish when dry, and grow in depressed mats in admixture with other bryophytes. Rhizoids are absent from the greater part of the thallus, but in the isolated areas where they occur they are fairly abundant, their development apparently being a response to contact with the substratum.

The axis, so far as one can be distinguished, is at first prostrate and shows long-continued growth (FIG. 13, I). Eventually, however, it turns upward and its growth is brought to an end. The living portion is mostly 0.5-1 cm. long, 0.5-1 mm. wide and 0.15-0.2 mm. thick. From the thickened median region, which is eight to ten cells from top to bottom, it gradually thins out toward the rounded margins, which show neither wings nor modified rows of cells. The marginal portions are more or less involute so that the thallus appears crescentic in cross section, the dorsal surface being concave and the ventral convex. The thallus in addition is irregularly sinuate and crispate along the margin. The cells on the upper surface are about 30 μ long and 23 μ wide, but on the lower surface they have an average width of only 15 μ. From these small surface-cells toward the interior a gradual increase in size is apparent, the internal cells being mostly 80-140 μ long and 30-40 μ wide (FIG. 13, J). The outer walls of the ventral surface-cells are slightly thickened; otherwise the walls are exceedingly thin and delicate.

The branching is very irregular, the branches sometimes being as much as 3 mm. apart and sometimes very closely crowded. Most of them spread obliquely and are essentially like the axis. When they are crowded they give rise, with their irregularly sinuate and crispate margins, to intricate clusters in which it is difficult to distinguish the component parts. Not infrequently the margins shows thickened regions, representing the growing points of new branches, and these make the clusters appear still more complicated. An occasional branch is subterete and stolon-like, consisting of little more than the thickened median portion, but such a branch retains the power of broadening out into a branch of the usual type.

Only a few male branches have been observed by the writer and these were not wholly satisfactory for study. They are narrower than ordinary branches, measuring about 0.3 mm. in width and bear a strong resemblance to the stolon-like branches, the thin marginal portions being reduced to vague and imperfect unistratose wings, scarcely more than a single cell wide. So far as the material indicates, the openings into the antheridial chambers are separated by two rows of cells. In one instance a male inflorescence had given rise to a secondary inflorescence, after producing about ten antheridia, and both the primary and secondary inflorescences had continued to develop additional antheridia to the number of ten or twelve. Each had then proliferated, one growing out into a flat branch and the other into a stolon-like branch. On the whole the male branches appear less differentiated than in the majority of the species.

No female branches have been seen in the writer's material. According to Stephani such branches are very short, conduplicately concave, incised-bilobed at the apex, and entire. He adds that the "calyptra" attains a length of 3 mm. and that its surface is smooth, except for a few long cilia at the base.

It would be impossible to confuse *R. crassicrispa* with any of the other Chilean members of the genus. It shows an approach, however, to *Aneura cochleata* (Hook. f. & Tayl.) Mitt. of New Zealand and Tasmania, a species which Stephani has recently reported also from the Falkland Islands and South Georgia (**32**, p. 6). *A. cochleata* is still incompletely known but is more robust than *R. crassicrispa,* the thallus having a width of 5 mm. and a thickness of sixteen cells. It differs further in its more definitely lobate thallus, the lobes being described as ovoid, cochleate, thick and fleshy, and two-lobed at the apex, thus representing apparently the latent rudiments of branches.

IV. EXCLUDED SPECIES

In the Introduction attention is called to several species of *Riccardia* which have been reported from Chile but about which there is more or less uncertainty. For the sake of convenience these species are again enumerated here, five being listed under the generic name *Aneura* to avoid the publication of new combinations.

1. Riccardia eriocaula (Hook.) Besch. & Massal.

Puerto Bueno, *Dusén* (**28**, p. 18, as *Aneura eriocaula*); Huafo Island and Puerto Gomez, Tierra del Fuego, *Skottsberg* (**28**, p. 7, as *A. eriocaula*).

The specimens cited under the var. *chilensis* have been included under *R. prehensilis,* and it is probable that these other records were based on specimens of the same species.

2. Aneura fragilis Steph. Bihang K. Svenska Vet.-Akad. Handl. **26**[3] (No. 17): 8. 1901. *Nomen nudum.*

Desolation Island and Rio Azopardo, Tierra del Fuego, *Dusén.*

According to a letter received from Professor Chodat of the University of Geneva, there are no specimens under this name in Stephani's collection.

3. Aneura fucoides (Sw.) Steph.

Straits of Magellan, reported by Montagne (**17**, p. 214, as *Metzgeria fucoides*).

According to Stephani (**27**, p. 680) this species is known from several of the West Indian islands, from Costa Rica and from Brazil. It is related to *R. Thaxteri* but is larger, and the wings of the ultimate branches are broader.

4. Riccardia multifida (L.) S. F. Gray.

Hermite Islands, *Hooker* (**14**, p. 479, as *Jungermannia multifida*; **34**, p. 444, under the same name, some of the specimens being referred to a var. *submersa*); Tuesday Bay, *Naumann* (**19**, p. 42, as *Aneura multifida*); Ushuaia, Tierra del Fuego, *Skottsberg* (**31**, p. 2, as *A. multifida*). Reported also from the Falkland Islands (**34**, p. 444; **31**, p. 2).

This well-known species of northern regions extends southward into the West Indies, but the reports from Chile are exceedingly doubtful. According to Taylor's own statements the var. *submersa* probably represents a distinct species (see **13**, p. 497), and Schiffner describes the specimens which he cites as being somewhat aberrant. Unfortunately none of the specimens quoted have been available to the writer.

5. Riccardia pinguis (L.) S. F. Gray.

Hermite Island, *Hooker* (**14**, p. 479; **34**, p. 445, as *Jungermannia pinguis*), near Valparaiso, *D'Orbigny* (**13**, p. 495, and **18**, p. 295, as *Aneura pinguis*); Cape Horn and Clarence Island, *Hariot,* and Hoste Island, *Hahn* (**2**, p. 243).

Since *R. pinguis* is almost cosmopolitan in its distribution its occurrence in Chile would not be surprising, and it is possible that some of the records are correct. One of Hooker's specimens has been referred in the present paper to *R. granulata* (see page 192); another specimen, likewise in the Mitten Herbarium, is clearly distinct and may represent an etiolated form of *R. pinguis.* In the absence of more typical material, however, it would hardly be wise to give this specimen a definite name. The specimens listed by Bescherelle and Massalongo have not been examined by the writer. Some of them are referred to the var. *denticulata* (Nees) Besch. & Massal., and it is possible that these might prove identical with Hooker's specimen. It may be noted in this connection that Stephani reports *R. pinguis* from the Falkland Islands (**31**, p. 2; **32**, p. 7), although he does not accredit it to Chile.

6. Riccardia pinnatifida (Web.) Trevis.

Without definite locality, Chile, reported by Montagne (**18**, p. 205); Tuesday Bay, *Naumann* (**19**, p. 42, as *A. pinnatifida*); Punta Arenas and Rio Azopardo, Tierra del Fuego, *Dusén* (**29**, p. 9, as *A. pinnatifida*); near Harberton, Tierra del Fuego, *Skottsberg* (**31**, p. 2, as *A. pinnatifida*).

This species is often known as *R. sinuata* (Dicks.) Trevis. Its specific limitations and geographical distribution are still incompletely understood, and reports from tropical and antarctic regions are especially in need of confirmation. The specimen from Tuesday Bay is described as richly branched with very narrow divisions, showing that it is clearly different from the typical form of *R. pinnatifida* and that it probably represents some other species. Unfortunately no details are given about the other specimens cited.

7. Aneura Poeppigiana (Lehm. & Lindenb.) Steph.

Concepcion, reported by Montagne (**18**, p. 298, as *Metzgeria Poeppigiana*).

Stephani cites the species from Peru only (**27**, p. 687); it is related to *A. fucoides* and *R. Thaxteri*, but is somewhat smaller than either.

8. Aneura pulvinata Steph. Bihang K. Svenska Vet.-Akad. Handl. **26**^{3} (No. 6): 19. 1900. *Nomen nudum.*

Corral, Puerto Bueno, Guaitecas Islands and Rio Aysen, *Dusén* (**28**, p. 19); Desolation Island, *Dusén* (**29**, p. 9).

Professor Chodat reports that this species is not represented in Stephani's collection. It may be noted, furthermore, that Stephani has since published another "*Aneura pulvinata*", based on Bolivian material collected by Herzog (see **33**, p. 39), so that he apparently no longer recognizes his earlier species of that name.

9. Aneura stolonifera Steph.

Straits of Magellan, *Cunningham* (**27**, p. 737). See, in connection with this report, page 182 of the present paper.

V. AFFINITIES AND PHYLOGENY OF RICCARDIA

The classification of the anacrogynous Jungermanniales is by no means firmly established. A number of recent writers associate *Riccardia* with *Metzgeria* and *Hymenophytum* in a special tribe or family, separated from the other thalloid genera by their short and specialized sexual branches and by the possession of an elaterophore extending downward from the apex of the capsule. To this group Cavers has given the family name Aneuraceae (5, p. 195).

In the large genus *Metzgeria* the thallus is characterized by broad unistratose wings and a thickened median portion containing a strand of elongated cells. It thus resembles the ultimate branches of such species of *Riccardia* as *R. crispa* and *R. hymenophylloides*, and it was natural for the older writers to refer species of this character to *Metzgeria*. In *Riccardia*, however, branches with broad wings are found only in the more highly differentiated forms and are usually associated with subterete and wingless axes of a higher order. In *Metzgeria*, on the other hand, the entire thallus is winged, a branch is essentially like the axis from which it arises, spreading from it dichotomously, and it is usually impracticable to distinguish branches of different ranks. The genus is further characterized (in most species at least) by distinctive appendicular organs in the form of long unicellular hairs, apparently derived from rhizoids. These are sometimes restricted to definite regions, such as the margins of the wings, but are often more generally distributed and may even cover over both surfaces of the thallus. The closest approach to these filamentous structures in *Riccardia* is found in such species as *R. eriocaula*.

Although the vegetative branches of *Metzgeria* are normally lateral in origin, just as in *Riccardia*, the sexual branches differ in being invariably ventral, growing out from the thickened median portion of the thallus. The male branches are far more delicate than the vegetative branches but show well-differentiated wings, which are strongly involute and cover over the antheridia. The latter are borne on the dorsal surface of the thickened median portion, as in *Riccardia*, but are not situated in depressions. The female branches are more like those of *Riccardia,* the archegonia being borne on the dorsal surface, but the wings are never cut up into teeth or laciniae and no other involucral structures are present. After fertilization a massive calyptra, covered over with hairs and derived largely from the venter of the archegonium, is developed.

It has been clearly shown that the genus *Hymenophytum* as earlier defined includes two distinct genera, to which the names *Umbraculum* and *Podomitrium* have been applied (see Cavers, **5**, p. 68, and Campbell and Miss Williams, **4**, p. 41). If the name *Hymenophytum* is restricted to the first of these genera, which includes *H. flabellatum* of New Zealand and Australia and its few allies, the thallus shows a differentiation which may be compared with that found in *R. Thaxteri.* In other words the basal portion forms a prostrate wingless rhizome and then curves upward and develops a richly branched photosynthetic system borne on a long stalk, which is likewise wingless throughout the greater part of its extent. Where the basal portion begins to curve upward it gives off a new prostrate portion which in turn forms a new photosynthetic system. By a repetition of this process a sympodial rhizome is formed, upon which the aerial portions seem to be laterally borne (see Goebel, **11**, p. 250, *f. 149*). The branches of the latter arise by a series of closely repeated dichotomies and are strongly flattened and winged, the whole system forming a semicircular and deeply lobed expansion bearing a strong resemblance to a leaf of some filmy fern. On the whole the differentiation here is more definite than in *R. Thaxteri,* although the thallus appears less complex.

The sexual branches of *Hymenophytum* are borne on the photosynthetic branch-systems and are ventral in position, as in *Metzgeria,* but the male branch is so reduced that the antheridia, each in a deep depression, seem to form a sessile cluster on the thickened median portion of the thallus. The female branches are more like those of *Metzgeria* and are in the form of short scales. After fertilization, in addition to the calyptra, a tubular sheath or pseudoperianth is developed around the young sporophyte.

The elaterophore of *Metzgeria* is less massive than that of *Riccardia* and the capsule wall is more delicate in texture, although the cells of the inner layer still show half-annular thickenings on their walls. In *Hymenophytum,* according to the published accounts, the elaterophore is even less developed and the irregular thickenings of the capsule-wall are restricted to the layer on the outside.

The genus *Podomitrium* contains only two species, *P. phyllanthus* (Hook.) Mitt. of New Zealand and *P. malaccense* (Steph.) Campbell (3) of the Malayan region. It is placed by Cavers in the Aneuraceae and agrees with *Hymenophytum* in having the sexual organs borne on specialized ventral branches and in developing a pseudoperianth. The sexual branches, however, are much better developed. The male branch shows a double row of antheridia, each protected by a scale, and the female branch develops a laciniate involucre around the archegonia. The thallus, moreover, is not highly differentiated like that of *Hymenophytum,* but is prostrate and consists (except for the short stalk-like base) of a flat strap-shaped expansion, in which the thickened median portion thins out gradually into unistratose wings. In the thickened portion a strand of narrow thin-walled cells is present, and even the vegetative branches are mostly ventral in origin. The most important differences, however, are found in the capsule, which lacks an elaterophore completely and shows a wall two or more cells thick without local wall-thickenings, the radial walls of the outer layer being uniformly thickened. In Campbell's opinion these differences are not only sufficient to separate *Podomitrium* generically from *Hymenophytum* but to show that its true affinities are with *Pallavicinia,* the largest genus of Cavers's family Blyttiaceae.

In the genus *Pallavicinia,* as typified by the widely distributed *P. Lyellii* (Hook.) S. F. Gray, the thallus is essentially like that of *Podomitrium* and the same thing is true of the capsule. The two genera agree further in the protective scales covering the antheridia, in the laciniate involucres around the archegonial clusters, and in the pseudoperianths around the young sporophytes. The sexual organs of *Pallavicinia,* however, instead of being borne on specialized ventral branches, arise in median groups on the dorsal surface of ordinary branches. Although such species as *P. Lyellii* agree with *Podomitrium* in the features of the thallus, the genus contains other species which agree better in these respects with *Hymenophytum.* These are the so-called dendroid species and are known only from tropical, south temperate and antarctic regions. They are often placed in the subgenus *Mittenia*, to which Gottsche originally gave generic rank. In these dendroid species, although the resemblance to *Hymenophytum* in vegetative features is so close, the sexual organs are borne dorsally on photosynthetic branches, and the protective structures associated with the sexual organs and sporophytes are essentially the same as in the more typical species of *Pallavicinia*.

Another member of the Blyttiaceae which helps to throw light on the affinities of the Aneuraceae is the large genus *Symphyogyna*, which is mostly tropical in its distribution. So far as its vegetative features are concerned this genus is essentially like *Pallavicinia* and contains both prostrate and dendroid species. It agrees further in the position of the sexual organs, in the general nature of their protective coverings, and in the structure of the capsule. It is distinguished mainly by its total lack of a pseudoperianth. The sporophyte here, as in *Riccardia*, is protected by a massive so-called calyptra, derived largely from a meristematic zone below the fertilized archegonium and bearing a cluster of unfertilized archegonia at its apex.

The comparison of the genera here discussed will show that their characters are not definitely distributed so as to form well-marked groups of genera. If *Hymenophytum* and *Podomitrium* are both retained in the Aneuraceae, as is done by Cavers, the only important difference between this family and the Blyttiaceae is derived from the sexual branches, which are short and more or less differentiated in the Aneuraceae and undifferentiated in the Blyttiaceae. If *Podomitrium* is placed in the Blyttiaceae, as Campbell suggests, then the only difference between the two families are those derived from the capsule, and *Hymenophytum* to a certain extent forms a connecting link between the two. These and similar considerations led Campbell and Miss Williams (4, p. 42) to the conclusion that there was no adequate basis for separating the Aneuraceae from the Blyttiaceae. The writer fully agrees with this conclusion and suggests that the two families be combined under the name RICCARDIACEAE. In this family the genera *Moerckia* and *Makinoa*, which Cavers places in the Blyttiaceae, should likewise be included. *Moerckia* is a genus of four northern species and is often regarded as a subgenus of *Pallavicinia*, while *Makinoa* is a well-marked monotypic genus of Japan.

Probably most students of the Hepaticae would agree that such species of *Riccardia* as *R. pinguis* represent generalized types, from which the more complicated types have been derived by progressive modification and specialization. Taking the genus as a whole, therefore, a flat dorsiventral thallus, with little evidence of histological or other differentiation, might be regarded as a sort of evolutionary center from which various lines have diverged.

This conception, unfortunately, throws no light on the phylogeny of the generalized types themselves, and the large amount of morphological work which has been done on the Hepaticae leaves this matter in equal obscurity. It is wholly uncertain, for example, whether an apparently simple thallus of this character is really primitive or whether it has been derived from some more complex type of gametophyte. If the latter is assumed, at least three possibilities present themselves. First, it may have descended from some leafy anacrogynous form. In this case the lateral leaves would have disappeared altogether, while the ventral slime papillae would represent the final vestiges of two rows of underleaves. In certain species of *Cephalozia,* such as *C. bicuspidata,* the underleaves on vegetative axes are represented by similar vestigial papillae in a single row, corresponding to the different type of apical cell found in this genus. Second, the simple thallus may have descended from some more complex marchantiaceous thallus. In this case the elaborate system of dorsal air-chambers would have undergone degeneration or simplification, leading to the complete obliteration of the chambers, and the two median rows of ventral scales would have failed to develop beyond the earliest papilliform stage. A similar simplification has evidently taken place in the marchantiaceous genera *Dumortiera* and *Monoselenium* and is usually regarded as an adaptation to a wet environment. Third, the long-lived thallus may represent the elaboration of the thalloid juvenile stage of some leafy form. The genera *Pteropsiella* and *Metzgeriopsis* are apparently examples of such a derivation, the juvenile thalloid condition persisting until the appearance of the sexual branches. It is possible that later investigations, especially upon the early stages of different gametophytes, will help clear up some of these questions.

Another feature of the thallus which increases the difficulty of tracing out its phylogeny is its constant dorsiventrality. According to current views dorsiventrality is not a primitive feature but is derived from a condition of radial symmetry. Among the bryophytes many of the mosses show radial symmetry clearly, not only in their sporophytes but also in their gametophytes, but this condition is exceedingly rare in the gametophytes of the Hepaticae. It is found in a typical form only in the two closely allied genera *Calobryum* and *Scalia*, the relationships of which to the other Hepaticae are still in doubt. There are certain other leafy genera, however, which approximate a radial condition very closely. In *Herberta*, for example, the large and deeply bifid underleaves are essentially like the leaves, and the same thing is true of other genera of the Ptilidiaceae. An approach to radial symmetry is to be observed also in the reproductive branches of such genera as *Cephalozia*, *Bazzania* and *Lepidozia*, while the flagelliform branches of the last two genera with their minute scale-like leaves are often strikingly radial in appearance.

It is possible that the types which have just been considered may give some idea of the primitive leafy hepatics. At any rate they show a closer approach to the radial mosses than do the more definitely dorsiventral types. In the Riccardiaceae, however, approximations to a radial condition seem to be derived secondarily from dorsiventral types. We find such approximations in the wingless and subterete rhizomes of *Hymenophytum* and the dendroid species of *Pallavicinia* and *Symphyogyna*; in the stalks of the photosynthetic branch-systems in the same forms; and in the axis and stolons of certain species of *Riccardia*, such as *R. prehensilis* and *R. Thaxteri*. In all these cases the subterete axes form portions of highly differentiated thalli and play little or no part in photosynthesis, but the photosynthetic branches are still flat and dorsiventral and thus retain the features of the undifferentiated type of thallus from which the others have probably been derived. There are apparently no subterete axes in any of the thalloid Jungermanniales that are clearly the phylogenetic predecessors of the flattened axes.

The phylogeny of the sporophyte in *Riccardia* is, if possible, even more of a mystery than that of the gametophyte. Goebel inclines to the idea (11, p. 544) that the sporophyte of *Anthoceros* approaches the primitive condition more closely than that of any other hepatic, basing his opinion largely on the fact that the sporophyte and gametophyte have several important features in common. In the *Anthoceros* sporophyte a definite photosynthetic tissue is present in the wall of the capsule, and the interior is occupied by a well-developed columella. From a sporophyte of this general character the sporophytes of the Jungermanniales and Marchantiales have presumably been derived by a process of degeneration or simplification, the photosynthetic tissue disappearing entirely and the columella either persisting in the form of an elaterophore or becoming completely lost. The final stage in the process is seen in the sporophyte of *Riccia*, which consists of a simple spherical spore-case, enclosed by a delicate and ephemeral wall.

According to another view, which is perhaps more prevalent, the *Riccia* type of sporophyte is to be regarded as primitive. From this type, by a process of sterilization and specialization, the more complex types of sporophyte have been derived, culminating in the most complex type of all found in the Anthocerotales. Whichever view is accepted it is clear that the sporophyte of *Riccardia* with its well-developed elaterophore, occupies an intermediate position in the series. It is apparent, therefore, that this sporophyte can not be regarded as a primitive structure, whatever views are held regarding the gametophyte.

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TERTIARY SPIDERS AND OPILIONIDS OF NORTH AMERICA

INTRODUCTION

The present study is based on collections placed at the disposal of the author through the courtesy of the Museum of Comparative Zoology of Harvard University, of the U. S. National Museum, of the American Museum of Natural History, of Professor W. H. Twenhofel of the University of Kansas and of Professor T. D. A. Cockerell of the University of Colorado. To the above institutions and gentlemen the author expresses his deep appreciation of the privilege thus accorded him not only to reinvestigate the types previously described by Scudder, but to add several new species to those already known. The author is also deeply indebted to Professor Charles Schuchert who was instrumental in obtaining most of the material above mentioned. Although the study of the specimens was completed some time ago the work was considerably retarded at first by extraneous activities of the author during the war time and later by the difficulty of getting the proper help in making the drawings. All attempts to photograph the material proved highly unsatisfactory. Only a few specimens come out sufficiently well to allow of reproduction. The majority of the specimens are so faint and their colour so much like that of the surrounding rock that no combination of rayfilters, plates and illumination systems is of help in differentiating the specimens from the rock. At the same time the specimens are sufficiently well preserved to be clearly seen, measured and drawn. Thus drawings proved in every way much more satisfactory than photographs and were prepared by Miss F. E. Lovett, Mr. H. D. Rhynedance and myself. The pictures given by Scudder on Plate XI of his stately volume on Tertiary Insects of North America are so good that the expense of redrawing them would not have been justified and the reader is referred to Scudder's work.

The collections above mentioned contain altogether two distinct and hitherto unknown species of Opilionids and forty-seven distinct species of spiders representing seventy-six specimens or 89 pieces since several specimens consist of two pieces each. Sixteen species of spiders are new to science and are described here for the first time. Besides the more or less complete specimens the Scudder collection of the Museum of Comparative Zoology contains also four impressions of single legs and eight cocoons. The latter were described by Scudder as belonging to a species which he named *Aranea columbiae*. I have not seen these specimens, nor do I include them in the present study because of the utter uncertainty of classification. That the specimens in question are spider-cocoons seems to be if not absolutely beyond doubt, at least highly probable. But even the family could not be identified with any degree of certainty, and the figures given by Scudder in his Tertiary Insects on Plate 2 make one believe that the cocoons in question are not all of the same species.

A few words of explanation are necessary concerning the recognition of species. Generally speaking it is much easier to recognize in a new palaeontological specimen a new species than to place it correctly in the system. Our knowledge of American Tertiary spiders was based on Scudder's work. A keen observer and a man broadly versed in the systematics of Arthropods, Scudder had no difficulties in assorting his material and describing the new species. He made minor mistakes, in a few cases he placed in the same species specimens distinctly belonging to different species, but the bulk of his species stand good to-day. At the same time Scudder has never been a professional arachnologist and the principles of classification gradually arrived at through the work of several distinguished European arachnologists remained unknown to him or did not appeal enough to him to be extended from the field of recent forms to that of extinct ones. Therein lies the weakness of Scudder's work. For although his species are good, the characters upon which their description is based, from the point of view of modern knowledge are entirely inadequate for the purpose of placing the species in the system. As will be pointed out further down, not only the generic characters, but even family characters as well as characters of entire sub-orders are usually so obliterated that Scudder had to rely mostly on external similarity. Naturally species of the same family have more resemblance to each other than to species of other families. External resemblance is the first principle in any assortment of large collections. At the same time, as is well known, it is one of the most misleading methods imaginable. In spiders this is particularly true. We have parallel lines of development in Theraphosid and true spiders and among the latter in cribellate and ecribellate spiders. The similarity is so great that for years *Uloborus* and *Hyptiotes* of the Cribellates were placed among the orbweavers of the Ecribellates. The Agelenids have their counterpart in Diplurids among the Theraphosids. The similarity between our common *Agelena naevia* and *Evagrus mexicanus* of the Diplurinæ is so striking that it extends over their behaviour and webconstruction, although *Evagrus* is more than twice the size of *Agelena* and on closer examination possesses all the distinctive characters of the group to which it belongs. Cases are known where external similarity has woefully misled the systematist. Thus a larva of a recent fly belonging to the genus *Microdon* has originally been described as a hard mollusk, and the cases constructed by some recent caddis-fly larvæ as shells. Misled by external similarity, the distinguished arachnologist Count Keyserling described a new genus of a cribellated spider, *Acanthoctenus* with two species as a new genus of the sub-order Citigradæ, because he did not pay attention either to the spinnerets or the metatarsus of the fourth leg. The synonymy contained in arachnological works demonstrates clearly that similar mistakes have been made repeatedly by most eminent arachnologists. It only shows that errors are very easy to make and that in the absence of most important characters such errors are inevitable. Under the circumstances a modern arachnologist may well condemn any attempt at classification of extinct spiders. In recent spiders it is a comparatively easy matter to place a specimen in its proper family, it is more difficult to assign it to a genus, and it requires often minute study of characters invisible to the naked eye to determine the species. In this respect the study of extinct forms practically reverses the difficulty. With few specimens in existence it is a comparatively simple matter to establish the fact that a specimen under observation belongs to a different species from those already known; but with very few exceptions it is absolutely impossible to place it correctly in the system. What then should be done? Obviously the species should be carefully described and provisionally placed in such a genus and family with the recent representatives of which it has most resemblance.

When it comes however to a comparison between American and European spiders extreme caution is necessary. With families and genera uncertain, what reliance can be placed upon deductions made from such a comparison? Scudder may be pardoned for his attempt to do it, but no excuse would be valid in the case of a man thoroughly versed in the modern systematics of recent spiders. Faunistic and climatic conjectures are therefore entirely out of place.

Another side of the investigation was also sadly disappointing to the author, namely the complete absence of any structures which would allow one to unravel the mystery of the origin of the method of reproduction peculiar to spiders. In those cases where the male palpi are well preserved they show that at that geological period the copulatory apparatus was already fully developed and occupied the same position as in recent spiders. In one case the epigynum of a female is also surprisingly well preserved and quite of the type found in recent species.

THE RELATIONSHIPS OF ARACHNIDA.

It may be not quite out of place here to consider first of all the relationships of Arachnida and their place in the System of Arthropoda. Already in my monograph of Palaeozoic Arachnida I have pointed out the reasons why Pycnogonida, Tardigrada and Pentastomida (Linguatulida) have no place among the Arachnida. On the other hand I have included under Arachnida the Gigantostraca and the Xiphosura (Limuloids). I have also given a definition of the Class Arachnida in conformity with our knowledge at that time. Since then I have done some extensive study of segmentation in Arthropods, part of which studies is in press at this moment. The readers interested in the subject are referred to this paper which will appear in the Journal of Morphology. But the results of the investigation may be briefly summarized as follows: The Lankesterian division of the body of an Arachnid into a prosoma, mesosoma and metasoma of six segments each is entirely untenable and must be dropped. The Xiphosura have much in common with the Arachnida, but also possess many features which make their relationship with the Arachnida more than doubtful. Their arterial circulatory system is perineural. Their carapace represents apparently not a fusion of the head with the thorax alone, but includes the first and second abdominal tergites. The segmentation of the scorpion shows the appearance of a spurious segment, but is in other respects similar to that of spiders. The carapace in all Arachnida represents the fusion of the tergites of the head and thorax, unless one or more of the thoracic somites are free, but it never includes any of the abdominal tergites. The arterial system is entirely independent of the nervous system and composed of supraneural, subneural and interneural arteries. Xiphosura cannot be regarded as ancestors of Arachnida for the same reasons. Very likely Xiphosura have Trilobites for ancestors as is also suggested by Raymond in his extensive monograph. The relationship of the Gigantostraca (Eurypterida) cannot be determined at present without further research. Provisionally at any rate they may be safely left with the Arachnida.

The new definition of the Class Arachnida may therefore be given in the following words. Arachnida are Arthropoda with heteromeric segmentation. Their body is composed of 21 somites four of which are prae-oral in the adult, the fourth somite bearing the chelicera. The first postoral somite belongs to the head and bears the pedipalpi. The thorax consists of four somites each provided with a pair of appendages, with the exception of some Acari in which only the first and second thoracic somites bear appendages. Head and thorax are usually fused into a cephalothorax, but in some Orders one, two or even three of the thoracic somites may remain free. The abdomen is composed of 12 somites, the first of which is rudimentary in the adult, being represented only by its neuromere, except in the Pedipalpi in which it persists throughout life. Further fusion of somites involves the posterior end of the abdomen, beginning with the last somite and proceeding forward. Secondary spurious segmentation in the abdomen, as in the case of the 18th somite of the scorpion, may result in the formation of an additional segment which does not possess the value of a somite. The anus is always on the last somite. The genital opening is on the eleventh (second abdominal) somite. Nephridia modified as coxal glands situated in the thorax. Respiration by means of lung-books or tracheæ, in some forms organs of respiration entirely absent. Circulatory system with a heart in which the cardio-aortic valve always marks the limit between the last thoracic and first abdominal somite (i. e. between the 9th and 10th somites). The reduction of the heart always begins at the posterior end and proceeds forward. The arterial system wherever fully developed consists of an aorta with its arch and pedal arteries and a series of interneural arteries connecting the supraneural with the subneural artery. The legs are typically of 7 joints the last of which in some cases may be subarticulated; the pedipalpi of 6 joints, the terminal joint corresponding to the last two joints of the legs. The cheliceræ are 2 or 3 jointed. The eyes whenever present are always simple, not more than 12 in number and belong to the first and second somites. External segmentation of the adult does not coincide with true segmentation.

To facilitate the understanding of the above definition the following table comparing apparent segmentation in several Orders of Arachnida with true segmentation may not be without practical value to students of extinct Arthropoda.

The Table needs little explanation. The transverse lines indicate the limits between segments as they actually appear to the eye, not as derived from the presence of appendages or from the study of internal anatomy and embryology. The somitic value of the sternum in the cephalothorax is omitted in all cases in order to emphasize the differences in the composition of the carapace as well as for lack of space. Attention is called to the fact that the normal or most primitive type of segmentation is found not in Scorpions but in Pedipalpi. There is still some difference of opinion concerning the eyes in Araneæ. Schimkewitsch and Scheuring homologize the indirect eyes of spiders with the median eyes of scorpions, and the direct eyes with the lateral eyes of scorpions. Schimkewitsch even gives a figure of the ganglia as derived from the study of sections in embryos of *Ischnocolus*. It seems to me however that the evidence adduced by the above mentioned investigators is not sufficient to decide the case in their favor and I retain for the present the homology of the median eyes of the scorpion with the direct eyes of spiders.

It is not impossible that Arachnida possessed originally a few somites *in front* of the eyes. Corresponding neuromeres have been figured by Schimkewitsch. If such is the case the body of an Arachnid is in reality composed of more than 21 somites, but

	SOMITES		SCORPIONES		PEDIPALPI		SOLIFUGAE		OPILIONES		ARANEAE		LIMULUS
CEPHALON	1 (1 C)	CARAPACE	MEDIAN EYES	CARAPACE	MEDIAN EYES	CARAPACE	MEDIAN EYES	CARAPACE	EYES	CARAPACE	DIRECT EYES	CARAPACE	MEDIAN EYES
	2 (2 C)		LATERAL EYES		LATERAL EYES		LATERAL EYES		?		INDIRECT EYES		LATERAL EYES
	3 (3 C)		ROSTRUM		ROSTRUM		ROSTRUM		ROSTRUM		ROSTRUM		? ROSTRUM
	4 (4 C)		CHELICERAE		CHELICERAE		CHELICERAE		CHELICERAE		CHELICERAE		CHELICERAE
	5 (5 C)		PEDIPALPI		PEDIPALPI		PEDIPALPI		PEDIPALPI		PEDIPALPI		PEDIPALPI
THORAX	6 (1 TH)		1 pair of LEGS		1 pair of LEGS		1 pair of LEGS		1 pair of LEGS		1 pair of LEGS		1 pair of LEGS
	7 (2 TH)		2 pair of LEGS		2 pair of LEGS		2 TERG. = 2 p. LEGS = 1 stig.		2 pair of LEGS		2 pair of LEGS		2 pair of LEGS
	8 (3 TH)		3 pair of LEGS		3 pair of LEGS		3 TERG. = 3 p. of LEGS		3 pair of LEGS		3 pair of LEGS		3 pair of LEGS
	9 (4 TH)		4 pair of LEGS		4 pair of LEGS		4 TERG. = 4 p. of LEGS		4 pair of LEGS		4 pair of LEGS		4 pair of LEGS
ABDOMEN	10 (1 A)	ABDOMEN	(First abdominal neuromere)	ABDOMEN	1 TERGITE = STERNITE	ABDOMEN	?	ABDOMEN	?	ABDOMEN	PETIOLUS		CHILARIA
	11 (2 A)		1 TERGITE = GENITAL OPERC.		2 TERG. = GEN. OP., 1 LUNG		1 Segment = GENITAL OPERC.		GEN. Arches = GENIT. OPERC.		GENITAL OPENING = 1 LUNGS		GENITAL OPERCULA
	12 (3 A)		2 TERGITE = COMBS		3 TERGITE = STERN., 2 LUNG		2 SEGMENT = 2 STIGMA		STIGMA		2 LUNGS or SPIRACLE	ABDOMEN	1 GILL-BOOKS
	13 (4 A)		3 TERGITE = 1 LUNGS		4 TERGITE = STERNITE		3 SEGMENT = 3 STIGMA		1 SEGMENT		CRIBELLUM and ANT. SPINNER.		2 GILL-BOOKS
	14 (5 A)		4 TERGITE = 2 LUNGS		5 TERGITE = STERNITE		4 SEGMENT = MEDIAN STIG.		2 SEGMENT		MED. and POST. SPINNERETS		3 GILL-BOOKS
	15 (6 A)		5 TERGITE = 3 LUNGS		6 TERGITE = STERNITE		5 SEGMENT		3 SEGMENT		ANAL TUBERCLE		4 GILL-BOOKS
	16 (7 A)		6 TERGITE = 4 LUNGS		7 TERGITE = STERNITE		6 SEGMENT		4 SEGMENT				5 GILL-BOOKS
	17 (8 A)		7 TERGITE = STERNITE		8 TERGITE = STERNITE		7 SEGMENT		5 SEGMENT				6 ABDOMINAL SPINE
	18 (9 A)		1 CAUDAL SEGMENT 2 CAUDAL SEGMENT		9 TERGITE = STERNITE		8 SEGMENT		6 SEGMENT				2 postbranchial neurom.
	19 (10 A)		3 CAUDAL SEGMENT		1 CAUDAL SEGMENT		9 SEGMENT		7 SEGMENT				3 postbranchial neurom.
	20 (11 A)		4 CAUDAL SEGMENT		2 CAUDAL SEGMENT		10 SEGMENT		OPERCULUM ANALE				
	21 (12 A)		5 CAUDAL SEGMENT		3 CAUDAL SEGMENT								

in absence of definite data it seems wiser to limit the discussion of homologies to somites the presence of which can be always demonstrated. The same holds true of Xiphosura.

CLASSIFICATION IN ARANEÆ.

Let us now proceed in detail with the discussion of the problem of classification in spiders and especially with that of identification of extinct species. Lest much of what I have said may seem to be unsupported by facts, arbitrary and attributable rather to personal shortcomings of the author than to poor preservation of the material itself, I shall give two examples and submit these to an exhaustive analysis so that the reader may form a judgment for himself. The spiders which I choose for this purpose, *Parattus resurrectus* and *Titanoeca ingenua*, are fairly well preserved. Both belong to the sub-order of Arachnomorphæ or True Spiders, characterized by the direction of the axis of articulation of the chelicerae, the presence of well developed maxillary lobes and the possession of a single pair of lungs and of a single (or of a pair) tracheal spiracle. Neither of these characters can be determined from an examination of the specimens in question, but the combination of other characters, the general appearance, the size, the proportion of the legs, the "*tout ensemble*" so to say, makes a mistake impossible. So far, so good.

The first sub-division of True Spiders is based on the presence or absence of a cribellum in front of the spinnerets and of a calamustrum on the fourth metatarsus. The Family Attidæ, to which according to Scudder who established the genus *Parattus* for three species of Tertiary Spiders that genus belongs, comes under the division Ecribellatæ. The absence of a cribellum and calamistrum in recent spiders may be ascertained without difficulty, but only with the aid of a lens. Moreover, the calamistrum can be seen only in a certain position of the leg. How much of these structures may have been preserved in extinct spiders? Spines and hair are well preserved in some specimens. Spinnerets, as a rule, are not nearly as well preserved. In *Parattus resurrectus* one can see with the aid of a good binocular dissecting microscope at a magnification of about 60 diameters simple brown hair on the spinnerets and similar hair and spines on all legs. No cribellum and no calamistrum are visible. In absence of traces of these structures we may reasonably assume that *Parattus* did not possess them, but the absence of a character is in itself not a sufficient proof, because in no case are all structures preserved.

Assuming then that *Parattus* actually did not possess these structures we may place it in the division Ecribellatæ. This division is composed of 28 families in recent spiders. What are the distinctive characters of the Family Attidæ? 1) Presence of a *single* spiracle immediately in front of the spinnerets; 2) Two tarsal claws and ungual tufts; 3) Eight eyes in three or four rows, anterior median eyes by far the largest, eyes of second row minute; 4) All eyes of the diurnal type; 5) Clypeus vertical; 6) Absence of colulus; 7) Body often covered with scales. Of these characters the relative size and position of the eyes is the most conspicuous and usually allows at once to recognize an Attid in a recent spider. How about *Parattus?* The eyes of the second row are not discernible in any of the three species. Scudder describes for *Parattus resurrectus* the "eyes of the second row from one-eighth to one-tenth the size of those of the first row, situated behind and within the middle anterior pair, so that lines drawn through the middle of the large and small ones would meet in a right angle behind the small ones and leave them distant from each other by about their own diameter; the outer edge of either of the small ones is behind the inner edge of one of the large ones" (p. 54). No similar position of the eyes of the second row is known to occur in any of the hundreds of recent Attidæ. If the little impressions which Scudder described as eyes of the second row actually represent eyes then *Parattus* is not an Attid at all. Similarly, if the anterior median eyes are equal in size to or scarcely larger than the anterior lateral eyes, then, as Scudder himself points out in his definition of the genus *Parattus*, this character separates *Parattus* "from all members of the Family." But the eyes of the third row being "not discernible" in *Parattus resurrectus*, "doubtful" in *Parattus latitatus* and preserved only in the otherwise poorly preserved specimen of *Parattus evocatus*, in which the eyes of the second row according to Scudder himself are "indiscernible," what value can be placed in the generic character when the corresponding family character is not in evidence?

Of the other six characters of the Family Attidæ enumerated above, characters the combination of which might have come to our help, not a single one can be recognized. Even in recent spiders the spiracle can be seen only with difficulty, the diurnal type of eyes is an expression of the internal structure and cannot be preserved, the clypeus, if properly preserved would appear only in a plane vertical to the surface of the specimen and the absence of the colulus is only a negative character. The claws could be seen under microscope if they were preserved, but although every spider has either two or three claws on each tarsus, none of the specimens in question show any trace of them. Similarly, although the specimens show well preserved hair and spines, there is no trace of scales. The evidence, such as there is, points therefore *against* the probability of Parattus belonging to the Family Attidæ.

But let us assume for the moment that *Parattus* is an Attid. The separation of Attidæ into genera is based on the following characters:—1) Number and structure of teeth on the lower margin of cheliceræ; 2) Size and shape of the entire eyegroup; 3) Relative position of the eyes of the second row; 4) Number of spines on the underside of the first tibia; 5) Number and distribution of other spines on legs; 6) Distance between the anterior coxæ; 7) Shape and especially elevation of carapace; 8) Shape of underlip; and 9) Shape of sternum. Most of these structures are either poorly preserved or entirely indiscernible. If the family relationship were definite then indeed the genus would be sufficiently characterized by the proportion of the anterior eyes and we could disregard the other characters. As for the specific differences given by Scudder for his three species of *Parattus* and consisting in the shape and proportions of the cephalothorax, these differences in recent spiders would undoubtedly have generic and not specific value. For the recognition of species in Attidæ is based chiefly on the structure of the male palpus and female epigynum, the distribution of color on the abdomen, carapace and legs, the type of hair and scales, modification of the legs, etc.

The case of *Titanoeca ingenua* (as well as that of *Titanoeca hesterna*) is still worse. The genus *Titanoeca* has been established by Thorell for spiders which belong to the division Cribellatæ. Scudder mentions the fact that this genus "is not far removed from *Amaurobius*," but in his description of both species he fails to mention altogether either the calamistrum or the cribellum. In fact he does not mention even the spinnerets. Yet the spinnerets are visible in *Titanoeca ingenua* which is by far the better preserved species. The spinnerets are far apart, reminding of recent Drassids. No cribellum is visible. The legs are extraordinarily well preserved and the fourth metatarsi do not show anything like a calamistrum. It is therefore not probable that the spider in question is either a *Titanoeca* or any other cribellate species. But while the exclusion of this species from the division of Cribellatae is a comparatively simple matter, it is almost impossible to establish its true relationships. On account of its general appearance and the structure of the spinnerets I have placed both species provisionally under the family Drassidæ.

Of the forty-seven species of spiders presented in this paper, *Nephila pennatipes* and *Tetragnatha tertiaria* are the only ones whose generic identity seems to be sufficiently well established. The three species of *Thomisus* undoubtedly belong to the family Thomisidæ, but the genus in its modern conception remains uncertain. The same may be said about the species referred to the genus *Epeira* of the family Argiopidæ (Epeiridæ). The genera *Tethneus, Parattus* and several new genera proposed by me all deal with extinct forms and have therefore a different value from genera of recent spiders. None of the remaining spiders can be placed in the system satisfactorily. In these cases I did not feel justified to establish new generic names, a procedure which is advisable only where it is sure that the species does not belong to the genus under which it was originally placed. Each case will be discussed separately. In each such instance the genus used by modern arachnologists for recent species may have only the value of a vague approximation.

ORDER ARANEÆ.

Spiders represent a very natural order and already in the Upper Carboniferous or Pennsylvanic Period are easily distinguishable from all other Arachnida. In all recent spiders with the exception of the family Liphistiidæ of the sub-order Mesothelæ and in all Tertiary spiders known the abdomen appears unsegmented. In all spiders without a single exception the abdomen is joined to the cephalothorax by means of a very thin petiolus representing the first abdominal somite. There is therefore a deep constriction between the carapace and the abdomen, whereas in Opiliones and Acari no constriction is noticeable because the abdomen is broadly joined to the cephalothorax. In Ricinulei the abdomen is also provided with a petiolus, but the coupling of the abdomen with the carapace is such that it has all appearance of a broadly joined abdomen. Moreover the Ricinulei possess a cucullus in front of the carapace. The Solifugæ have certain similarity with spiders although their abdomen is broadly joined to the carapace. What permits an easy separation of the Solifugæ from the spiders is the difference in the structure of their carapace and cheliceræ. The carapace in Solifugæ represents the fusion of the cephalic tergites with the first thoracic tergite, leaving the second, third and fourth thoracic tergites free, whereas in spiders all thoracic tergites are fused with the cephalic tergites. The cheliceræ of spiders are retrovert, those of Solifugæ chelate. From other orders of Arachnida in which the abdomen is also joined to the carapace by means of a petiolus the spiders can be distinguished by their cheliceræ and pedipalpi. In recent forms confusion is impossible. In extinct forms members of the sub-order Amblypygi of the order Pedipalpi could be easily confused with spiders if the preservation were deficient. In such cases the relative size and position of the coxæ comes to our aid. The possession of spinnerets on the abdomen is an exclusive characteristic of spiders, and if spinnerets are preserved spiders can be recognized as such even if all other characters are indistinguishable or missing.

Tertiary spiders possess already all the characters of recent spiders, including the epigynum in females and the copulatory apparatus on the terminal joint of the palpus in the male. The external appearance of Tertiary spiders is much the same as in common spiders of the present time and their habits, in a general way, must have been similar. It is difficult to say whether the paucity of material is attributable to the poor conditions prevailing in the Tertiary for the preservation of spiders, or to the relative paucity of the spider fauna itself of that period. For the recent spider fauna runs into several hundred as against the forty-seven Tertiary spiders of the same geographical region. Considering the numerous species preserved in the European amber we may reasonably assume that the real number of American Tertiary spiders must have been considerable.

SUB-ORDER MYGALOMORPHÆ.

Spiders with an unsegmented abdomen and two pairs of lungs. Articulation of cheliceræ such that the fangs move in a plane parallel to the plane of symmetry.

This sub-order comprises two families, Aviculariidæ and Atypidæ.

FAMILY AVICULARIIDÆ.

Usually four, sometimes two spinnerets. (Anterior spinnerets belonging to the fourth abdominal somite and found in Atypidæ and other spiders are missing in Aviculariidæ.) Eyes eight or six, usually situated on an elevation and forming a compact group. Anterior median eyes alone of the diurnal type. Coxæ of pedipalps without maxillary lobes.

A very large family comprising almost all recent Theraphosid spiders and practically limited to the equatorial and tropical belts. In this country the family is represented by some thirty species, most of which are distributed through the southern states and California. One species was found in Virginia, another in the Indian Territory. I have a single specimen of a species new to science and as yet unpublished from Indiana.

The separation into sub-families and genera of spiders belonging to the family Aviculariidæ is based on the following characters: structure of the tarsi and number of claws, number and structure of spinnerets, presence or absence of a rastellum on the cheliceræ, number of eyes and configuration of eyegroup, shape of carapace and sternum.

Being unable to place the single species of Theraphosid spider from Florissant under any of the numerous recent genera, I propose the new genus *Eodiplurina* for Tertiary forms more or less related to the recent sub-family Diplurinæ.

Genus **Eodiplurina**, new.

Theraphosid spiders with two pectinated claws and two pairs of spinnerets of which the posterior pair is three jointed and much longer than the anterior pair. Genotype: *E. cockerelli.*

Eodiplurina cockerelli n. sp. (*Text figures 1 and 2*).

A very well preserved specimen of a female, on both pieces showing only the ventral surface. Total length including cheliceræ 15 mm. Abdomen 7 mm. long. Outline of carapace not visible.

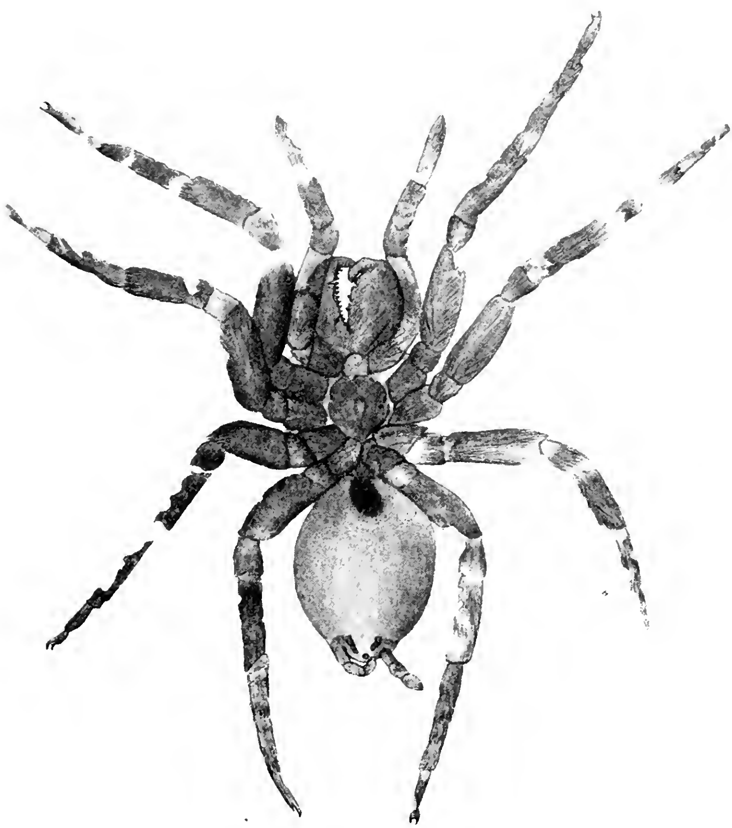

FIGURE 1.—*Eodiplurina cockerelli* n. sp. x 13.

Cheliceræ heavy, their inner margin with a row of dark, distinct granules and a thick scopula. The fangs are not well preserved. Coxa of pedipalps without maxillary lobe. Lip about as long as wide. Sternum almost circular. Anterior coxæ widely separate, posterior ones contiguous. Abdomen oval, lighter in color, sparsely covered with thick, simple hair, with a darker spot in the middle of the genital area. On one side of the dark spot two faint impressions, one behind the other, possibly imprints of the lung-books. The spinnerets are well preserved, covered with simple hair, spinning tubes not discernible. First pair of spinnerets small and far apart. Second pair large, three-jointed, at least three times as long and considerably stouter than anterior spinnerets. Pedipalps with a pectinate claw. Legs and pedipalps covered with simple, thick hair and scattered spines which are rather weak. Tarsal joints of legs apparently without scopula, with a pair of pectinate claws. The claws of the third right

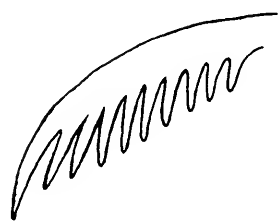

FIGURE 2.—*Eodiplurina cockerelli* n. sp. A claw of the third left foot. x 135.

tarsus (in the specimen on the left side) are especially well preserved. Its structure is shown in *textfigure 2* drawn with the aid of an Abbe drawing apparatus at a magnification of 135 diameters. The claws are with a series of from 8 to 9 teeth increasing in size from the base of the claw distally. Legs: 4123.

MEASUREMENTS OF THE LEGS IN MILLIMETERS.

	Femur	Patella + Tibia	Metatarsus	Tarsus	Total
I Leg	3.7	5.2	2.5	2.0	13.4
II Leg	3.6	?	?	?	13.0
III Leg	3.7	?	?	?	11.6
IV Leg	4.0	?	?	?	10.7
Pedipalp	2.3	3.1	2.0		6.4

The specimen is in the collection of Professor T. D. A. Cockerell of the University of Colorado and is from Florissant.

I am unable to place this species in any recent genus. It shows certain relationship with Brachythele which however have claws with a double series of teeth and other characters partly different partly indiscernible in *Eodiplurina cockerelli.*

SUB-ORDER ARACHNOMORPHÆ.

Spiders with an unsegmented abdomen and a single pair of lungs. Usually a single median tracheal spiracle in front of the spinnerets, sometimes a pair of them. Articulation of cheliceræ such that the fangs move in a plane intersecting the plane of symmetry.

This sub-order can be naturally divided into two divisions:

1 DIVISION CRIBELLATÆ.

True spiders with a cribellum in front of the spinnerets and a calamistrum on the fourth metatarsi.

Eight recent families belong to this division. Some of the species are exceedingly common. There are however no representatives of Cribellated spiders among the Tertiary spiders of North America.

2 DIVISION ECRIBELLATÆ.

True spiders without a cribellum or calamistrum. This division comprises 28 families of recent spiders. We shall mention only those families with which the Tertiary spiders are more or less directly concerned.

1 SUB-DIVISION HAPLOGYNÆ.

This sub-division comprises six families of spiders in which the external genital organs are comparatively simple in structure and resemble those in Theraphosid spiders. Three of the six families, namely Oonopidæ, Dysderidæ and Caponiidæ, have two pairs of spiracles on the abdomen. In the Caponiidæ both pairs lead into tracheal tubes. In the Oonopidæ and Dysderidæ the first pair leads into lung-books, the second into tracheal tubes. In the remaining three families, namely Sicariidæ, Leptonetidæ and Hadrotarsidæ the spiracles are distributed so that a pair of them belongs to the lung-books, and a single median spiracle leads into the tracheal tubes.

The Caponiidæ have eight eyes, the Oonopidæ and Dysderidæ have six eyes. The Dysderidæ have a colulus in front of the spinnerets, the Oonopidæ have none.

Family Dysderidæ.

Characters of the family:—Two pairs of spiracles, the first of which belongs to lung-books, the second to tracheal tubes. Six eyes. Cheliceræ long and obliquely inclined. Lip very long. Maxillary lobes parallel. Anterior coxæ long, cylindrical Six spinnerets, anterior and posterior ones of about the same length while the median ones are sometimes shorter. Colulus present. Tarsi with two or three claws, upper claws with a single series of teeth, median claw smooth.

The sub-family Segestriinæ is characterized by the shape of the sternum which is much as in other spiders. The two genera, *Segestria* and *Ariadna,* of which the sub-family is composed, are separable by the position of their eyes and the structure of cheliceræ. Both genera are widely distributed.

Genus *Segestria* Latreille.

Segestria secessa Scudder (*Textfigure 3*).

Scudder, Tertiary Insects, 1890. P. 61. Pl. 11. fig. 28.

Two females, one of these being No. 205 (now No. 71) of the Scudder Collection of the Museum of Comparative Zoology of Harvard University, the other Nos. 1806 and 1818 of the Princeton Collection. Both from Florissant.

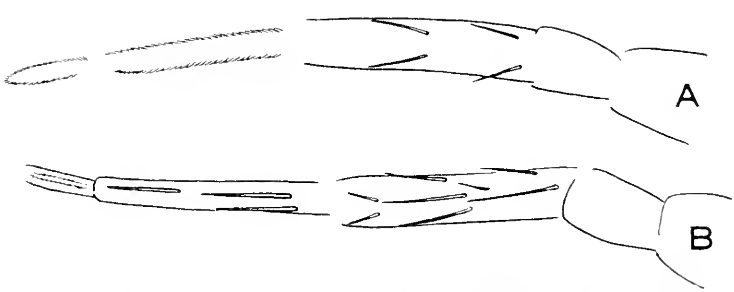

Figure 3.—*Segestria secessa* Scudder. Specimen No. 205 (71). Legs: a, first left; b, fourth left. x 13.

The Harvard specimen is the type of the species and the only one which I have examined. It is a beautifully preserved specimen although the impression is rather faint. The spiracles are altogether indiscernible. The claws are too poorly preserved to be studied under higher power and the sternum is not clear. The generic affiliation of the species is therefore entirely based on external similarity with recent representatives of the genus Segestria. Scudder's description and measurements are correct and need not be repeated here. It may be added that there are two pairs of spines on the underside of the first, second and third tibia (the first left leg is shown in *textfigure 3a*). The metatarsi of the third pair have also two pairs of spines below. The tarsi and metatarsi of the first and second pair of legs show a distinct scopula of short hair. The fourth pair of legs has more spines than any other, but the spines are not so regularly arranged (*textfigure 3b*). Legs in order 4123.

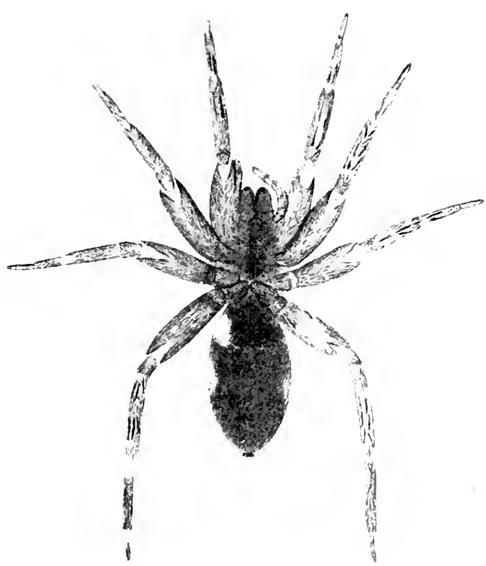

FIGURE 4.—*Segestria scudderi* n. sp. x 3.33.

Segestria scudderi n. sp. (*Textfigure 4*).

A single female No. 16379 (now No. 117) of the Scudder Collection of the Museum of Comparative Zoology in Harvard University.

The specimen is almost complete, but poorly preserved, the surface of the rock being eroded and uneven. The specimen presents only the ventral surface. It may be separated from the preceding species by its somewhat larger size and the greater length of the fourth pair of legs as compared with the first pair. Body and legs are covered with long, simple hair. There are many spines on all legs, apparently forming two ventral rows of three spines each on all tibiæ and metatarsi, but the unevenness of the surface makes a definite counting impossible. The spiracles are not preserved, the spinnerets appear as a darker spot at the end of the abdomen, but their structure or number cannot be made out. The sternum is distinctly oval, longer than wide, but its margin is not clear. The chelicerae are strong, their fangs are not visible. The pedipalpi are both well preserved, slender and short. The legs are rather robust, in the order 4123. The total length including chelicerae is 11 mm. The carapace, not showing any outline of its margin, cannot be measured. The abdomen is 6.5 mm. long and 3 mm. wide and has more or less parallel sides.

Measurements of the Legs in Millimeters.

	Femur	Patella + Tibia	Metatarsus	Tarsus	Total
I Leg	3.2	3.1	1.6	1.4	9.3
II Leg	3.0	3.1	1.5	1.4	9.0
III Leg	3.0	2.4	1.5	1.5	8.4
IV Leg	3.6	3.7	2.3	1.8	11.4

I have placed this species represented by a single specimen from Florissant under the genus *Segestria* merely because of its external similarity with the preceding species.

2 Sub-Division Entelegynæ.

This sub-division comprises twenty-two families of spiders in which the external genital organs are more complicated. In the female the genital opening is provided either with a *claustrum* or an epigynum. In the male the copulatory apparatus on the terminal joint of the pedipalp is provided with variously formed chitinized structures in addition to the embolus.

To the families recognized by Simon, only few of which we shall consider here, I thought it advisable to add a new family Parattidæ for the four species of Tertiary spiders referred to the genus *Parattus*.

FAMILY DRASSIDÆ.

Characters of the family:—Eyes eight, heterogeneous, forming two rows of four eyes each. Anterior median eyes alone diurnal. Maxillary lobes with a distinct obliquely transverse depression. Tarsi with two claws and ungual tufts. Anterior spinnerets far apart. Colulus wanting.

Genus **Palæodrassus**, new.

With the characters of the family. The appearance of the spinnerets makes it fairly certain that these spiders belong to the same family with recent Drassids, but it would be impossible either to place them under any recent genus or to separate the genus *Palæodrassus* from recent genera. It is very likely that in reality the species described under this genus belong to several genera. Four of the species may be readily separated from each other by the order of their legs which is 4123 in *P. ingenuus*, 4213 in *P. interitus* and *P. hesternus* and 4321 in *P. cockerelli*. The order of legs in *P. florissanti* is not known. Genotype: *P. ingenuus*.

Palæodrassus ingenuus (Scudder) (*Textfigures 5, 6*).

= *Titanoeca ingenua* Scudder, Tertiary Insects, 1890. P. 69. Pl. 11, figs. 29 and 32.

Four females from Florissant in the Scudder collection of the Museum of Comparative Zoology of Harvard University, numbered 9792, 11203, 13520, 14031 are mentioned in Scudder's work. Of these specimens however numbers 11203 (now No. 82) and 13520 (now No. 83) are the obverse and reverse of the same specimen, while No. 9792 (now No. 81) seems to belong to a different species, yet is too poorly preserved to warrant separation. I have not seen specimen 14031.

Scudder's description of this species refers entirely to Nos. 11203 and 13520 and is correct. He made a mistake in placing it in the genus *Titanoeca* and in the family Agelenidæ to which that genus does not belong. I have already pointed out that the absence of a cribellum and calamistrum makes the retaining of this species in the genus *Titanoeca* impossible. Nor do I think that there is any likelihood of its belonging to the family Agelenidæ, representatives of which are easily recognized because of the relative length of their posterior spinnerets. Nor can it be a Clubionid because its anterior spinnerets are not close together, but far apart.

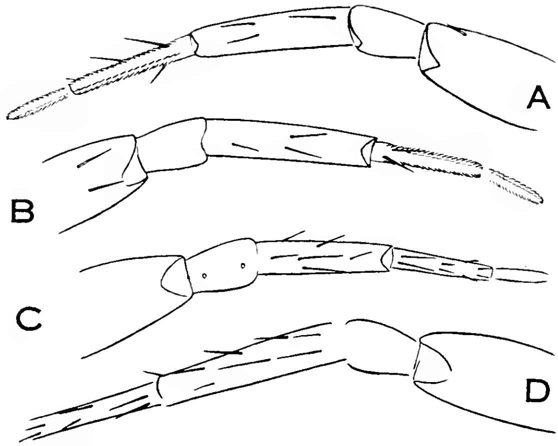

FIGURE 5.—*Palæodrassus ingenuus* (Scudder). Specimen No. 13520 (83). Legs: a, first left; b, second right; c, third right; d, fourth left. x 10.

The legs of this species are represented in our *textfigure 5*, the first and fourth being left legs, while the second and third right legs. It will be noticed that there is a distinct scopula on the first and second tarsi and metatarsi, a condition quite common among Drassids. There are three distinct spines on the underside of the first and second tibia, one of these close to the base, the other two forming a pair a little beyond the middle of the joint. There are also two or possibly three spines on the underside of the first and second metatarsi, and a pair of spines on the underside of the first and second femur close to the apical end of the joint. The spines on the third and fourth leg are more numerous. We find a median row of three equidistant spines on the underside of the tibiæ accompanied by several lateral spines, and three pairs of spines on the underside of the metatarsi apparently accompanied by a pair of lateral spines. There are also two circular sockets for spines on the third patella, but the spines themselves are missing as spines are often broken off in life and still more commonly after death. Legs in order 4123.

The specimen of *Palæodrassus ingenuus* presents also the peculiar spectacle of a well preserved epigynum (*Textfigure 6.*) Scudder has entirely overlooked its presence. It is surrounded by hair and its appearance is best understood from the drawing which I have made with the aid of an Abbe Drawing apparatus

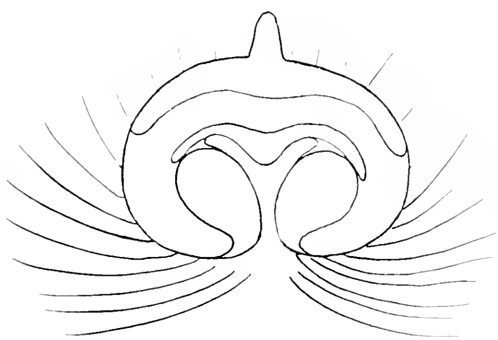

FIGURE 6.—*Palæodrassus ingenuus* (Scudder). Specimen No. 13520 (83). Epigynum. x 135.

at a magnification of 135 diameters. It reminds more that of a *Gnaphosa* rather than *Drassodes*, but in absence of any evidence derived from the study of the lower margin of the cheliceræ, which unfortunately is not distinct, the similarity in the epigynum would be insufficient to warrant the inclusion of the species in a definite genus.

Palæodrassus hesternus (Scudder) (*Textfigure 7*).

Titanoeca hesterna Scudder, Tertiary Insects, 1890, p. 69.

Four females, Nos. 5656, 12006, 12977 and No. 1809 of the Princeton Collection. Of these Nos. 5656 (now No. 84) and 12006 (now No. 85) are the only ones which I have had opportunity to examine and are both in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

The description given by Scudder is correct and I cannot add anything material to it, except a figure of specimen No. 5656 and the statement that the spinnerets are indiscernible and that there is no calamistrum on the fourth metatarsi. No. 12006 is less complete but at the same time the better preserved of the two specimens. The hair and the heavy, long spines on the legs are quite clear, and the scopulæ on the first and second tarsi and metatarsi are also very distinct. Legs in order 4213.

FIGURE 7.—*Palæodrassus hesternus* (Scudder). Specimen No. 5656 (84). x 5.

Palæodrassus florissanti n. sp. (*Textfigure 8*).

One female from Florissant in the T. D. A. Cockerell Collection of the University of Colorado.

The specimen presents the ventral surface with the outline of the carapace superimposed. The specimen is very poorly preserved and is referred to this indefinite genus on account of its spinnerets. Of these the anterior ones are cylindrical, far apart, the posterior ones much shorter, approximated and occupying the space between the anterior ones. Total length of the spider including cheliceræ—7 mm. The abdomen is somewhat pressed out of shape and is 4 mm. long. Sternum longer than wide, pointed posteriorly, truncated in front, more or less oval in shape. Lip longer than wide. Cheliceræ weak, pedipalpi slender. The legs are not complete except for the right second leg which is 5.1 mm. long. The femora are heavy, widest in their distal third. Strong spines, some of black color, are on all femora and on the preserved sections of tibiæ. There is also simple hair covering the entire body and legs. Nothing else can be made out.

FIGURE 8.—*Palæodrassus florissanti* n. sp. x 5.

Palæodrassus cockerelli n. sp. (*Textfigure 9*).

One female from Florissant in the T. D. A. Cockerell Collection of the University of Colorado. (Two pieces, both showing the ventral surface of the same specimen.)

Preservation very poor. Total length 8.5mm., abdomen 4.6mm. long. The legs of the right side (left on the specimen) are complete, and in order 4321. Total length of leg I—4.8 mm., leg II—5.1 mm., leg III—5.2 mm., leg IV—7.2 mm. Scopula present on first and second tarsi and metatarsi. Spines on third and fourth femur, tibia and metatarsus. Spinnerets visible, but their structure indistinct. Simple hair on body and legs. Pedipalps slender.

Palæodrassus interitus (Scudder) (*Textfigure 10*).

= *Anyphæna interita* Scudder, Tertiary Insects, 1890, p. 67. Plate 11, fig. 5.

One female from Florissant, Nos. 8269 (now 80) and 8281 in

FIGURE 9.—*Palæodrassus cockerelli* n. sp. x 5.

the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

That the spider in question does not belong to the genus *Anyphæna* under which Scudder had placed it "provisionally," induced to do so by "the general appearance of the specimen," cannot be doubted. In *Anyphæna* which is a Clubionid the anterior spinnerets are approximated and the tracheal spiracle is situated far in advance of the spinnerets. This spiracle may be seen in *Anyphæna* easier than in any other spider owing to the peculiar arrangement of the hair which forms two longitudinal lines parallel to each other and extending from the spiracle to the spinnerets. Scudder has not paid any attention to either of these characters. The spinnerets are represented in our figure 10 and are characterized by the wide separation of the anterior pair and the comparatively heavy appearance of the posterior pair. The median spinnerets are quite small. All spinnerets are covered with hair, but spinning tubes are not discernible. There is no trace of a spiracle but the arrangement of the hair on the abdomen does not reveal anything in the shape of two parallel lines. The eyes cannot be made out clearly and I am unable therefore to verify Scudder's description of them. On the other hand the sternum,

FIGURE 10.—*Palæodrassus interitus* (Scudder). Specimen No. 8269 (80). Spinnerets. x 20.

not mentioned by Scudder, is clearly visible and has the shape of a very regular oval. Legs in order 4213. Other characters as well as the measurements given by Scudder are correct and there is nothing I could add to them.

FAMILY CLUBIONIDÆ.

Characters of the Family:—Eyes eight, in two rows of four eyes each, usually only the anterior median eyes of the diurnal type. Maxillary lobes without obliquely transverse depression. Tarsi with two claws and ungual tufts. Anterior spinnerets approximated. Colulus wanting.

So close is the relationship between this family and Drassidæ that for a long time the two were regarded as a single family. Simon in his great work has placed the Clubionidæ after the Thomisidæ with whom they certainly have a great deal of relationship, and before the Agelenidæ. He has enclosed in the family the Selenopidæ and the Ctenidæ. I think these two are better regarded as separate families. It seems to me further that the Salticidæ (Attidæ) show also distinct relationship with some Clubionids both in structure and in habits.

The separation of the Clubionidæ into sub-families is based on the structure of the maxillary lobes, of the lip and of the posterior spinnerets and on the position of the tracheal spiracle immediately in front of or considerably in advance of the spinnerets:

Scudder has described four species of *Clubiona* and one species of *Anyphæna*. The latter, as I have shown above, is a Drassid and not a Clubionid. Of the former I left only *Clubiona arcana* in the genus *Clubiona* on account of the order of the legs, which is the same as in recent species of that genus. For the other three species three new genera had to be established, based on the order of their legs. The number of species placed under the family Clubionidæ has been increased to seven by the addition of three new species.

TABLE FOR THE SEPARATION OF TERTIARY GENERA OF CLUBIONIDS.

1.	The fourth leg is the longest.............	Clubiona
	*Not so	2
2.	The first leg is the shortest..........	Eobumbratrix
	*Not so	3
3.	Second leg as long as first	Eoversatrix
	*Second leg much shorter............	Eostentatrix

Genus *Clubiona* Latreille.

The genus *Clubiona* as limited and defined at present is much more restricted than it was when Latreille first proposed it. It is difficult to say whether the three species referred by me to this genus really belong to it. It did not seem necessary to create a new genus although a number of recent Clubionids possess the same order of legs. As applied to Tertiary spiders we may define this genus as possessing the characters of the family and the legs in order 4123.

Clubiona arcana Scudder.

Scudder, Tertiary Insects, 1890, p. 64. Plate 11, fig. 4 (♂).

Scudder describes one male No. 2831 and three females Nos. 3253, 7087 and 8082 of the collection in the Museum of Comparative Zoology of Harvard University and one female No. 1. 807 and 1. 819 of the Princeton Collection. I have examined only No. 2831 (now No. 73), No. 3253 (now No. 74) and No. 8082 (now No. 75). The females are poorly preserved. Scudder's description is accurate. It may be added that the spinnerets which are visible in the male are approximated and that the male copulatory apparatus has unquestionable similarity to that of recent Clubionids. Of course, the details of its structure cannot be made out nor can it be decided whether the females belong really to the same species with the male.

Clubiona florissanti n. sp. (*Textfigure 11*).

One female from Florissant in the collection of T. D. A. Cockerell of the University of Colorado.

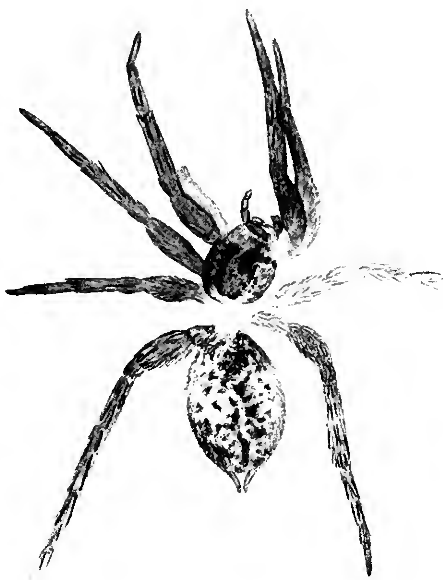

FIGURE 11.—*Clubiona florissanti* n. sp. x 5.

The specimen is almost complete, but poorly preserved. It is even impossible to decide which surface is preserved, although the presence of spines in the median line of the legs makes one think that we have the dorsal surface before us. Total length 6.5 mm. Abdomen oval, 4.2 mm. long, 2.7 mm. wide in the middle. Measurements of legs:—First leg—6.1 mm., second—5.7 mm., third—5.0 mm. and fourth—6.8 mm. The individual joints are not clearly separable. Body and legs are clothed with simple brown hair. It is difficult to decide whether the first and second tarsi have a scopula or not. There are many distinct spines on the legs, but their arrangement is not clear. The spinnerets are approximated, but displaced and poorly discernible. No other structures can be made out satisfactorily.

Clubiona curvispinosa n. sp. (*Textfigure 12*).

One female from Florissant, No. 16377 (now No. 120) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University. The specimen presents the ventral surface

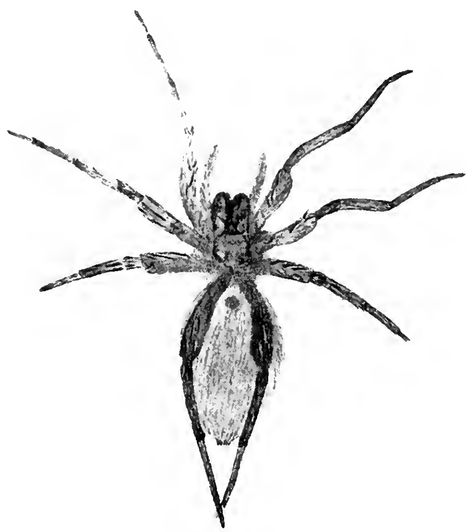

FIGURE 12.—*Clubiona curvispinosa* n. sp. x 5.

and is complete, but rather poorly preserved. The legs of the fourth pair are superimposed over the abdomen, meeting far beyond its end. Total length of the spider—6.9 mm. Immediately behind the fourth coxæ which are contiguous, a darker area in the middle line apparently represents the epigynum. The spinnerets appear as a similar dark area at the end of the abdomen, but neither their shape nor their number can be made out. Taking these two areas as points for measurement we may assume that the abdomen is approximately 4.2 mm. long. The outline of the carapace is also visible, though indistinctly. The carapace seems to have been pressed out of shape, but in the live spider was probably very wide in front. The legs are in order 4123. The fourth leg is 7.6 mm. long, the first—6.3 mm. The interesting feature of the armature of the legs is furnished by the strong, curved spines on all femora. Less powerful but also curved spines are found on all other joints except the tarsi. The fourth tarsi alone are well preserved and are thickly clothed with hair. Entire body and legs are covered with both long and short, simple hair. No other structures are discernible.

Genus **Eoversatrix**, new.

With the characters of the family, but with the legs in order 1243. Genotype: *E. eversa.*

Eoversatrix eversa (Scudder).

= *Clubiona eversa* Scudder, Tertiary Insects, 1890, p. 63.
Plate 11, fig. 22 (♂).

Scudder describes two males from Florissant, Nos. 5944 and 8551. Of these I have seen only the former which is now No. 72 of the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is very good and need not be repeated here. All I have to add is that body, palpi and legs are clothed with simple hair. Also, Scudder does not mention the spinnerets which however are well distinguishable notwithstanding the fissure in the specimen. While one may not make out the details of their structure, it seems to be certain that they are all approximated. The order of legs 1243 is sufficient for the separation of this species in a separate genus, since in all recent species of *Clubiona* the fourth leg is the longest.

Genus **Eobumbratrix**, new.

With the characters of the family, but with the legs in order 2431. Genotype: *E. latebrosa.*

Eobumbratrix latebrosa (Scudder).

= *Clubiona latebrosa* Scudder, Tertiary Insects, 1890, p. 65 Plate 11, fig. 18 (♂).

One male from Florissant in the Scudder Collection of the Museum of Comparative Zoology of Harvard University, No. 6492 (now No. 76).

The description of Scudder is correct. The spinnerets are scarcely discernible, but seem to be approximated. The order of legs 2431 removes this species from all genera of recent Clubionids in which the third leg is always the shortest.

Genus **Eostentatrix,** new.

With the characters of the family, but with the legs in order 1423. Genotype: *E. ostentata.*

Eostentatrix ostentata (Scudder) (*Textfigure 13*).

= *Clubiona ostentata* Scudder, Tertiary Spiders, 1890, p. 65. Plate 11, fig. 24 (♂).

Two males Nos. 199 (now No. 77), 5507 and 5910 (now No. 78) and one female No. 9624 (now No. 79) from Florissant in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

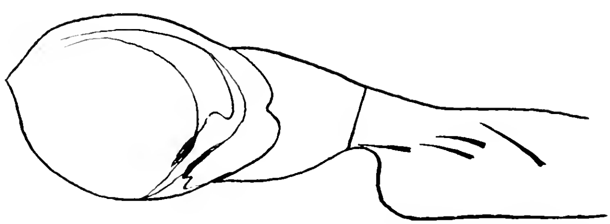

FIGURE 13.—*Eostentatrix ostentata* (Scudder). Specimen No. 5910 (78). Left pedipalp. x 40.

Scudder's description is correct. It may be added that the spinnerets are clearly visible in the male specimen No. 5910 and are approximated. The same specimen shows the pedipalps beautifully. The bulb of the copulatory apparatus has the appearance of recent Clubionids. The tibia of the pedipalp is distally enlarged owing to the presence of an apophysis. The patella of the pedipalp has also an apophysis and is besides provided with four spines. The structure of the copulatory apparatus itself is not distinct, but appears as a dark area with curved edge possibly representing a long curved embolus. Legs in order 1423.

The female is very poorly preserved and it is impossible to decide whether she actually belongs to the same species.

Eostentatrix cockerelli n. sp. (*Textfigure 14*).

One female from Florissant in the collection of T. D. A. Cockerell of the University of Colorado.

The specimen is well preserved and shows the ventral surface with the outline of the carapace impressed over the coxæ. Total length 11 mm. Carapace 3.1 mm. long, 3.1 mm. wide, subrotund. Abdomen 5.5 mm. long, 4.8 mm. wide, joined to the carapace by a long petiolus. Cheliceræ week, slightly divergent. Pedipalpi slender and somewhat longer than carapace. Legs in order 1423. First leg—16.1 mm. long, second—15.0 mm., third—12.8 mm., fourth—15.9 mm. They are clothed with simple hair. Strong spines are present on all legs, but they are not numerous, nor can their arrangement be made out clearly. The spinnerets are approximated, the posterior ones longer than the anterior ones, clothed with simple hair, but spinning tubes indiscernible. The body is also covered with simple hair which is long and brown in color. Nothing else can be made out.

FAMILY PARATTIDÆ, NEW.

A family of extinct spiders of the sub-order Arachnomorphæ, division Ecribellatæ and sub-division Entelegynæ, having a general resemblance to Attids and jumping Clubionids and probably closely related to both. In absence of other tangible characters on account of the poor preservation of the specimens, the family may be characterized by the arrangement and proportion of the eyes, as described for *Parattus oculatus*, the main points being, that the eyes are round, in two rows of four eyes each, anterior eyes subequal and fairly equidistant, posterior eyes considerably smaller, the posterior median eyes situated between and slightly behind the anterior median eyes.

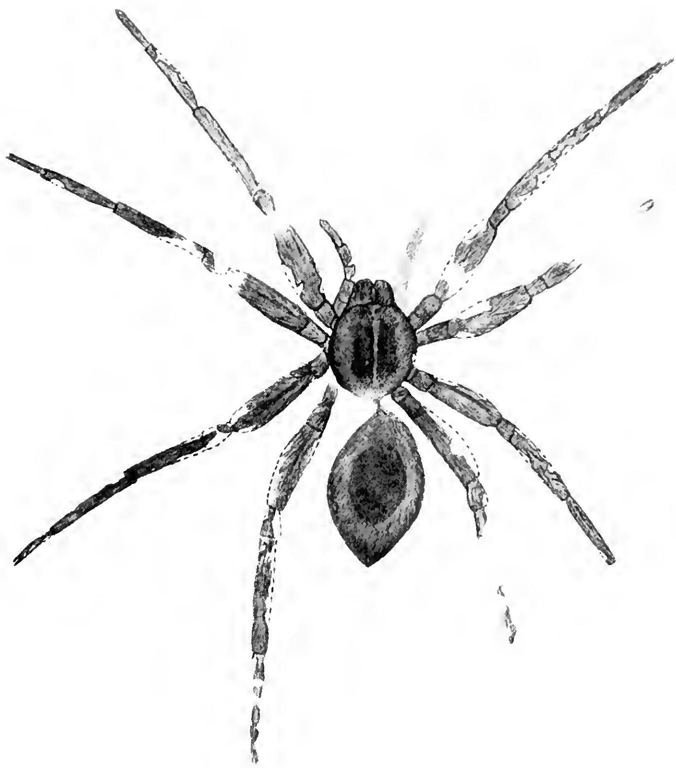

FIGURE 14.—*Eostentatrix cockerelli* n. sp. x 3.3.

Genus *Parattus* Scudder.

With the characters of the family.

Parattus resurrectus Scudder (*Textfigure 15*).

Scudder, Tertiary Insects, 1890, p. 53, Plate 11, fig. 26 (♀ ?).

One male No. 1081 (now No. 64) and one female Nos. 8450 and 8282 (now 65) from Florissant in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

I have discussed this case above and have little to add. Our *textfigure 15* shows the arrangement of the spines on all legs. As the legs on the right side are completely preserved we can state positively that there is no scopula either on the tarsi or metatarsi. The claws are not well discernible, but it seems that there are only

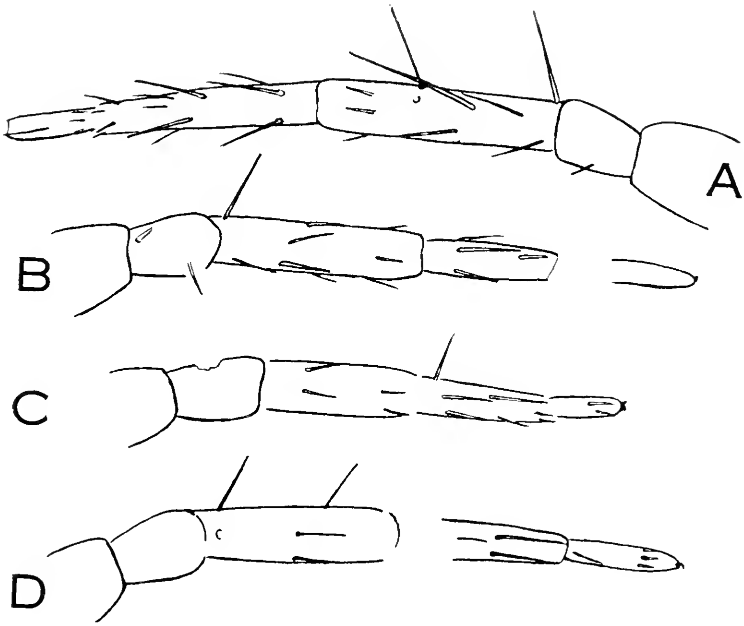

FIGURE 15.—*Parattus resurrectus* Scudder. Specimen No. 8282 (65). Legs: a, first left; b, second right; c, third right; d, fourth right. x 20.

two claws and that both are smooth. It would be impossible to decide whether the two specimens represent the male and the female of the same species. Legs in order 1243.

Parattus evocatus Scudder (*Textfigure 16*).

Scudder, Tertiary Insects, 1890, p. 54.

One female, No. 12005 (now No. 66) from Florissant in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

It is difficult to ascertain whether Scudder's description of the species is correct or erroneous. At one time I thought to see two rows of eyes, more or less equidistant and equal in size, one procurved, the other recurved, but on reëxamination after the lapse of some time I was unable to verify my own rough sketch. Each femur shows a median row of three spines above and two or three

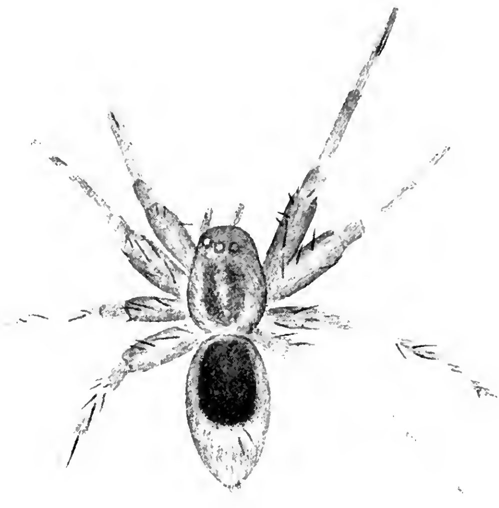

FIGURE 16.—*Parattus evocatus* Scudder. Specimen No. 12005 (66). x 5.

lateral spines. Body and legs are clothed with simple hair visible under higher power.

Parattus latitatus Scudder (*Textfigure 17*).

Scudder, Tertiary Insects, 1890, p. 55.

One specimen from Florissant, No. 9823 (now No. 67) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

The specimen is very poorly preserved and its sex as well as its generic affiliation remains uncertain. As far as can be ascertained, Scudder's description is correct. There are a few stout spines visible on the legs which are incomplete. The body is covered with simple hair.

FIGURE 17. *Parattus latitatus* Scudder. Specimen No. 9823 (67). x 5.

Parattus oculatus n. sp. (*Textfigures 18 and 19*).

One female from Florissant, No. 118 of the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

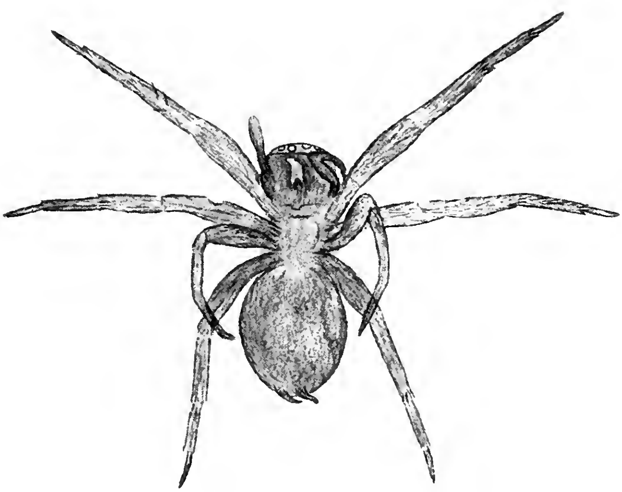

FIGURE 18.—*Parattus oculatus* n. sp. Specimen No. 118. x 5.

An exceedingly poorly preserved specimen apparently presenting the dorsal aspect although there is no clear outline of the carapace. Here and there a few spines may be seen on the legs, but even the lines between the joints cannot be made out. It is a small stout spider measuring 7 mm. in length. Order of legs 1243. Total length of leg I—8.0 mm., leg II—7.5 mm., leg III—6.8 mm., leg IV—7.2 mm.

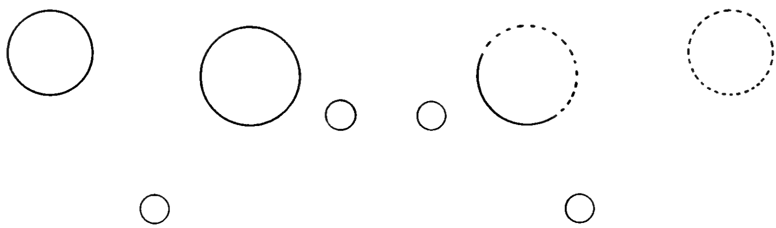

FIGURE 19.—*Parattus oculatus* n. sp. Specimen No. 118. Eyes. x 70.

The only really well preserved organs are the eyes (*textfigure 19*). They are eight in number and apparently only the right anterior lateral eye is completely indiscernible. Of the right anterior median eye a part of the outline is preserved and the remaining eyes are clearly visible. The anterior row is slightly procurved and much longer than the strongly recurved posterior row. The anterior median eyes are the largest and are about 1.75 their diameter apart. The anterior lateral eyes are also large, but distinctly smaller than the anterior median eyes and are separated from the latter by 1.50 their diameter. The eyes of the second row are considerably smaller, their diameter being about 3.50 times smaller than the diameter of the anterior median eyes. All eyes of the second row are of the same size. The posterior median eyes are situated between and slightly behind the anterior median eyes, are twice their diameter apart from each other and about one diameter from the respective anterior median eye. The posterior lateral eyes are behind and to the outside of the anterior median eyes from which they are removed by three diameters, while the distance between the posterior lateral and posterior median eyes is about six of their diameters. This arrangement of the eyes agrees closely with the description given by Scudder for *Parattus resurrectus* and is the reason why I have placed the otherwise so poorly preserved specimen without hesitation under the genus *Parattus*.

FAMILY THOMISIDÆ (LATERIGRADAE).

Characters of the Family:—Eight eyes in two rows, all diurnal, lateral eyes largest. Legs modified for lateral, crab-like locomotion. Tarsi with two claws, with ungual tufts. Spinnerets contiguous, with a distinct colulus in front of them.

Although several groups of spiders have laterigrade locomotion, the Thomisids are usually easily recognizable. Usually they are smaller than either the Selenopidæ or the Heteropodidæ and are distinguishable from the former by the position of the eyes and from the latter by the structure of the metatarsi. Moreover neither of these has a colulus. The generic distinction of Thomisids involves the study of the maxillary lobes, lip, sternum, margines of cheliceræ, hair etc., all characters not sufficiently apparent or completely indiscernible in extinct specimens. The three species which Scudder refers to the genus *Thomisus* are unquestionably Thomisids and his choice of genus is fortunate, for we may again regard it as merely a representative, indeterminate genus.

Genus *Thomisus* Walckenaer.

Thomisus resutus Scudder.

Scudder, Tertiary Insects, 1890, p. 57, Plate 11, fig. 13.

A single specimen of uncertain sex from Florissant, Nos. 5502 (now No. 68) and 7521 in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

The specimen is poorly preserved and its description given by Scudder is correct in all details.

Thomisus disjunctus Scudder.

Scudder, Tertiary Insects, 1890, p. 58, Plate 11, fig. 9.

Scudder describes two specimens from Florissant, one No. 9677 (now No. 69) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University, the other No. 10377 which I have not seen.

Scudder's description is correct except for his statement that "the tibiæ and first tarsal joint are completely consolidated into a single piece, so that the line of demarkation can not be seen." Examination of the legs under higher power reveals the presence of a semicircle of short hair, marking the end of the tibia and the beginning of the interarticulate membrane between the tibia and the metatarsus. Short hair is discernible on all joints of the legs.

Thomisus defossus Scudder (*Textfigure 20*).

Scudder, Tertiary Insects, 1890, p. 59, Plate 11, fig. 23 (♂).

One male from Florissant, No. 4742 (now No. 70) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is correct and all I have to add is that I was able to expose the end of the third right tarsus and thus reveal the presence of two curved claws (*textfigure 20*). The left claw is somewhat turned sideways and partly covered with what seems to be hair but may be remnant of flat sharp-pointed ungual tufts. The right claw shows distinctly a single median tooth.

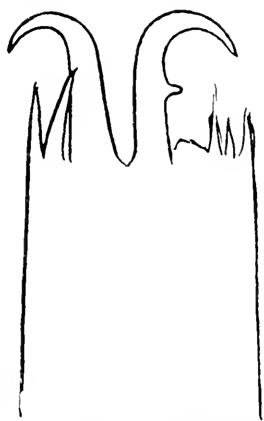

FIGURE 20—*Thomisus defossus* Scudder. Specimen No. 4742 (70). Claws of right third foot. x 135.

FAMILY LINYPHIIDÆ.

Characters of the Family:—Eight eyes in two rows, anterior median eyes alone diurnal. Spinnerets approximated, preceded by a colulus. Chelicerae with oblique margins. A stridulating organ on the outer surface of the chelicerae with a corresponding part on the inner surface of the pedipalpi. No comb on fourth tarsi. Clypeus high.

The separation into sub-families is based chiefly on the structure of the palpi in both sexes and the separation into genera on characters the majority of which are not easily ascertainable even in recent forms, especially in the case of females. Most of the recent spiders belonging to the sub-family Erigoninæ are minute, those of the sub-family Linyphiinæ larger and often resembling Theridiids with which they were originally classified, but from which they are easily separable by the structure of their fourth tarsi and cheliceræ.

Genus *Linyphia* Latreille.

Scudder has placed a single species under this genus. I have placed under it Scudder's *Theridium seclusum* which is certainly not a Theridiid and two new species. All these species have the general appearance of recent Linyphias, but it is impossible to say whether they actually belong to this genus.

Linyphia seclusa (Scudder).
= *Theridium seclusum* Scudder, Tertiary Insects, 1890, p. 74, Plate 11, fig. 20 (♂).

Scudder described three specimens, but one of these is a distinctly different species and has been placed by me under the genus *Palæopachygnatha*. This leaves two specimens of which No. 7816 I have not seen. The figure and description given by Scudder referr to specimen No. 9026 (now 88) of the Collection of the Museum of Comparative Zoology of Harvard University, which I have carefully examined.

It is a well preserved male. The description given by Scudder is correct. It must be added that the fourth tarsi are well preserved and show no trace of a comb. There are distinct spines of the Linyphiid type on all joints except tarsi.

Linyphia retensa Scudder.

Scudder, Tertiary Insects, p. 75, Plate 11, figs. 25, 27 (♂).

A single male and its reverse have been described by Scudder under the Nos. 12976, 13212 and 14032. Of these I have seen only No. 12976 (now No. 89) of the Scudder Collection of the Museum of Comparative Zoology of Harvard University. The specimen is very poor and as far as I can judge Scudder's description is correct.

Linyphia florissanti n. sp. (*Textfigure 21*).

One specimen, probably a male, from Florissant in the T. D. A. Cockerell Collection of the University of Colorado. It is very poorly preserved.

I am not at all certain under which family this specimen should be placed. There are no spines on the legs which are clothed with simple hair. The claws are not preserved, the eyes are indiscernible, neither can the spinnerets be seen. Only its general appearance reminds of a Linyphiid.

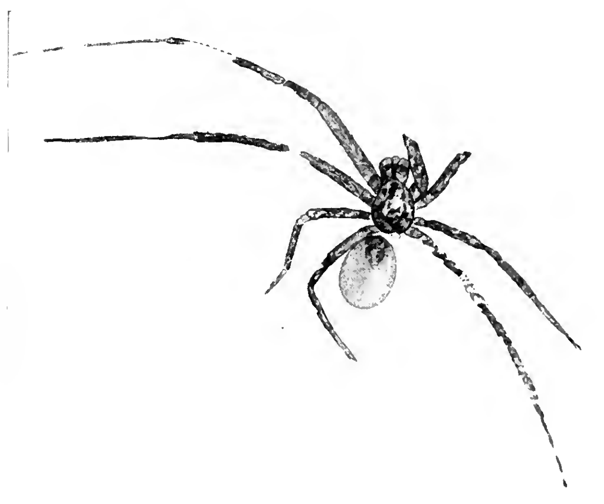

FIGURE 21.—*Linyphia florissanti* n. sp. x 3.33.

Total length including chelicerae—6.2 mm. Carapace longer than wide, being 2.1 mm. long and 1.9 mm. wide in the widest place, i.e. between the second and third coxae. It is eggshaped, pointed anteriorly. The outline of the sternum appears impressed inside the carapace. Its anterior end is not clearly visible, but the first coxae are distinctly widely separate. The posterior end of the sternum is pointed, slightly yet distinctly separating the fourth coxæ. The chelicerae are large and heavy. A dark area not shown in the drawing, but having the appearance of a copulatory apparatus of a male pedipalp, is visible at a little distance in front of the chelicerae. The abdomen is perfectly oval. The legs are long, in order 1243. The end of the first leg is difficult to trace, but the entire leg is considerably heavier than the fourth leg. Measured to its visible end it is 15.7 mm. long, the second leg—13 mm., the third—6 mm., and the fourth—9 mm.

Linyphia pachygnathoides n. sp. (*Textfigures 22 and 23*).

One male from Florissant, No. 38124 in the Collection of the U. S. National Museum.

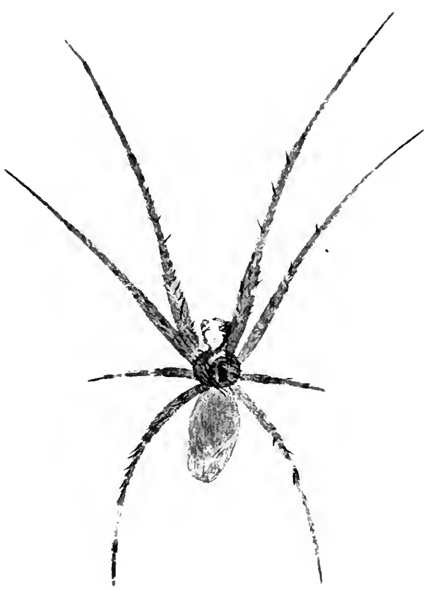

FIGURE 22.—*Linyphia pachygnathoides* n. sp. Specimen No. 38124. x 3.33.

The name chosen for this species is to indicate a close resemblance in the structure of its pedipalp to that in the recent genus *Pachygnatha*. As our *textfigure 23* shows, the tibia of the pedipalp has no apophysis. The end of the tarso-metatarsal joint projects beyond the copulatory apparatus. The structure of the latter is not clearly discernible, yet it seems to have a more or less spiral arrangement as indicated by dark streaks represented as lines in the drawing.

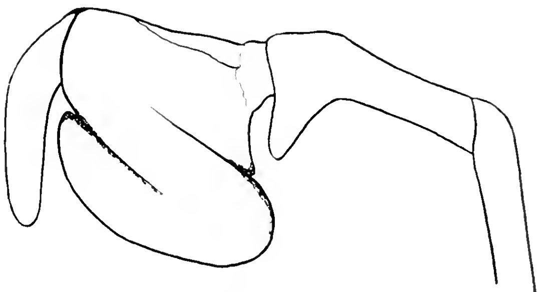

FIGURE 23.—*Linyphia pachygnathoides* n. sp. Specimen No. 38124. Right pedipalp. x 70.

Total length of spider—about 4 mm. Abdomen—2.5 mm. long, 1.3 mm. wide. The legs are slender, in order 1243. They are covered with short brown hair. Here and there a few weak, short spines are visible, forming various angles with the axis of the leg (from 24 to 58 degrees). The separate joints are clearly visible only in the first pair of legs. Here the femur measures 3.7 mm., patella with tibia—4.5 mm., metatarsus with tarsus—6.8 mm., total 15.0 mm. In the second leg only the metatarsus is clearly separated from the tibia and together with the tarsus measures 5.0 mm., while the total length of this leg is 12 mm. The third pair of legs is poorly preserved and cannot be even correctly measured. As far as visible it measures about 5 mm. The fourth pair of legs is complete although separation of the joints is not clear. Its total length is 9 mm.

FAMILY ARGIOPIDÆ.

Characters of the Family:—Eight eyes in two rows, all diurnal. Spinnerets approximated, preceded by a colulus. Cheliceræ with oblique margins with several teeth. Legs with spines. Tarsi with three claws and with several spurious claws (serrated bristles).

The family is usually divided into three sub-families which may be distinguished as follows:

Cheliceræ without boss at base......Tetragnathinæ
Cheliceræ with a boss at base
Lip longer than wide ....Nephilinæ
Lip wide and short................Epeirinæ

SUB-FAMILY TETRAGNATHINÆ.

Genus **Palaeometa**, new.

Presumably with the characters of the sub-family, but with eyes on a transversely oval elevation. Genotype: *P. opertanea.*

Palaeometa opertanea (Scudder).

= *Theridium opertaneum* Scudder, Tertiary Insects, 1890, p. 73.
Plate 11, fig. 3 (♀).

One female from Florissant, No. 13521 (now No. 86) in the Collection of the Museum of Comparative Zoology of Harvard University.

The specimen is imperfectly preserved and inadequately described by Scudder. Total length 11 mm. Carapace 5.0 mm. long, 2.2 mm. wide, abdomen 6.4 mm. long, almost globular. The legs are slender, imperfectly preserved. The third and fourth leg of the left side appear superimposed over the abdomen, the tip of the fourth leg protruding beyond the abdomen and at the first glance simulating a spinneret. However, it is not difficult to trace the leg on the surface of the abdomen owing to the arrangement of the hair which presents a different direction from that of the hair covering the abdomen, as the leg lies at an angle to the main axis of the spider. There are distinct spines on the first and second pair of legs, giving them an appearance entirely different from that of recent Theridiids. Moreover there is no trace of a comb on the fourth tarsus. This makes the retention of the species in the genus to which Scudder referred it impossible. The proportion of the femora indicates the probable proportion of the legs and is as given by Scudder: first femur—6.0 mm., second—5.0 mm., third—2.0 mm., fourth—3.25 mm.

The carapace shows a large transversely oval area which has the shape of a depression in the rock and which therefore represented an elevation in life. It seems probable that this represents the entire eyegroup, but the individual eyes cannot be made out. No other structures are discernible.

Genus **Palæopachygnatha**, new.

Spiders resembling recent *Pachygnatha*. Cheliceræ strongly divergent. Genotype: *P. scudderi*.

Palæopachygnatha scudderi n. sp. (*Textfigure 24*).

= *Theridium seclusum* Scudder ad partem specimen No. 2286 (now No. 87) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

FIGURE 24.—*Palæopachygnatha scudderi* n. sp. Specimen No. 2286 (87). x 3.33.

One specimen from Florissant, probably a female.

This species, which Scudder has erroneously identified with his *Theridium seclusum*, is at once easily separable from the latter by the difference in the relative length of its legs and the appearance of its cheliceræ. The cheliceræ are strongly divergent, a circumstance which decided me in placing the species under a genus allied to *Pachygnatha* with which the spider has external resemblance. The specimen has a very faint appearance, yet is well preserved. Its anterior legs as well as the legs of the second pair are broken off across the femora. The third and fourth pair are complete, but the claws are indiscernible. There is no trace of a comb on the fourth tarsi. The legs are clothed with simple brown hair and show a few spines. One of the spines is plainly visible on the third right tibia, two spines on the fourth left metatarsus.

Total length with cheliceræ 7 mm. Carapace oval, apparently slightly longer than wide, although its anterior edge is not clearly defined. The abdomen is oval. The total length of the third leg is 7.1 mm., that of the fourth—11.6 mm. The pedipalpi are not discernible.

Palæopachygnatha cockerelli n. sp. (*Textfigure 25*).

One male from Florissant in the T. D. A. Cockerell Collection of the University of Colorado.

FIGURE 25.—*Palæopachygnatha cockerelli* n. sp. x 3.33.

The specimen, presenting the dorsal surface only, is not very well preserved and little detail can be made out. In general the spider has the appearance of a recent *Pachygnatha*. The cheliceræ are hidden under the copulatory apparatus of the pedipalpi.

but are apparently divergent. The carapace is slightly longer than wide. The abdomen is oval, widest in its middle, evenly narrowed at both ends. Legs in order 1243. They are clothed with simple brown hair. There are distinct spines on all legs, especially on the femora.

Total length of spider about 6.8 mm. The first leg measures 13.5 mm., the second—10.5 mm., the third—4.5 mm., and the fourth—9 mm.

Genus *Tetragnatha* Latreille.

Tetragnatha tertiaria Scudder (*Textfigure 26*).

Scudder, Arachnida in Zittel's Handbuch der Paleontologie, Vol. I, II, p. 744, Fig. 927, 1885.

Scudder, Tertiary Insects, 1890, p. 77, Plate II, fig. II (♂).

One male from Florissant, Nos. 5000 (now No. 62) and 5898 (now No. 90) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

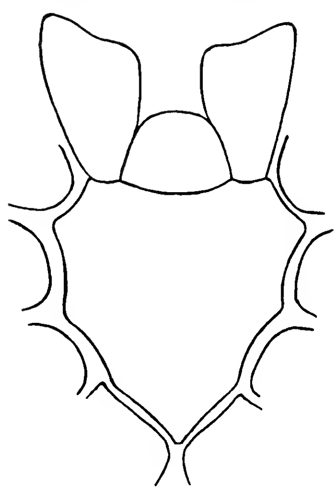

FIGURE 26.—*Tetragnatha tertiana* Scudder. Specimen No. 5898 (90). Sternum, lip and maxillary lobes. x 13.

A very well preserved specimen. Scudder's description is not complete omitting to mention such structures as the lip, maxillary lobes, sternum and spinnerets. Moreover he mistook the maxillary lobes for what he terms "the basal piece of the mandibles."

The sternum, represented in our *textfigure 26*, is wide in front, pointed behind, scarcely separating the hind coxæ. It is slightly emarginate anteriorly, receiving the wide underlip at the sides of which the maxillary lobes may be seen. They are more or less typical of *Tetragnatha* being considerably wider at the end than at the base and in a general way parallel to each other.

In front of the maxillary lobes the cheliceræ may be plainly seen. They have been probably pressed out of their position as their base is now in contact with the anterior edge of the maxillary lobes, a circumstance which misled Scudder in his interpretation of these structures. The cheliceræ are comparatively short and stout and strongly divergent. The left shows the fang complete. It is a little shorter than the basal joint, lighter in color, smooth and slightly but evenly curved. Considering that the specimen is unquestionably a male the cheliceræ are not typical, or perhaps I should better say not of the extreme type found in some recent species of the genus, but more of the type of the recent female *Tetragnatha laboriosa*. Impressions of the copulatory apparatus of the pedipalpi may be seen at a little distance in front of the cheliceræ, but the other joints of the pedipalp, which probably was slender, are not discernible.

The carapace is clearly visible on the specimen No. 5000 (now No. 62). Its anterior edge extends a little beyond the base of the cheliceræ, cutting them across. I have mentioned that the cheliceræ are apparently dislocated. The median line of the carapace comes to lie not between the chaliceræ, but slightly to the left, so that of the eyes which are plainly impressed across the base of the cheliceræ the right median eye lies in the juncture line of the two cheliceræ. The carapace is anteriorly narrower than posteriorly. Its widest place is between the second and third pair of coxæ where it measures 2.6 mm. while the length of the carapace is 3.5 mm. It is therefore distinctly longer than wide and oval in shape. Between the posterior edge of the carapace and the anterior edge of the abdomen a narrow space is bridged by the petiolus which has the shape of an elongated pentagon with the apex reaching the sternum and with sides slightly concave. Measured without the petiolus the abdomen is 4.6 mm. long and 2.3 mm. wide. The total length of the spider including chelicera is 10 mm.

The two rows of eyes are very slightly recurved and the posterior row slightly longer than the anterior row. All eyes are round and subequal in size, only the anterior median ones slightly but distinctly smaller than the others. The eyes of the anterior row are separated from each other by equal distances measuring less than their diameter, but more than their radius. The same is true of the posterior row, the greater length of this row being due to the equal size of its eyes and to the ever so slightly greater distance between them. The rows are to all purposes parallel and the free distance between the rows is twice the diameter of the eyes. The quadrangle of the median eyes is therefore considerably longer than wide. The clypeus is unusually narrow, measuring less than the diameter of the anterior middle eyes. It may be added that the eyes of the anterior row are quite plainly visible, while those of the posterior row are discernible only when the light falls under a certain angle.

The spinnerets are well preserved on specimen No. 5898 (now No. 90). The anterior pair is almost contiguous. They have the appearance of brown discs with a smaller and well circumscribed disc inside the larger. This represents probably the terminal article of the spinneret, but no spinning tubes are discernible. The posterior spinnerets are smaller and are separated from each other by at least their diameter. Between the posterior spinnerets there is a darker area possibly representing the median spinnerets. In front of the spinnerets the colulus can be plainly seen as a small brown disc.

The first and second pair of legs are broken off apparently across the tibiæ. The third and fourth pair are complete. Scudder did not see the ends of their tarsi. When fully exposed the third leg measures 9.8 mm., the fourth—19.2 mm. The length of the femora is given correctly by Scudder as follows:—First femur 8.75 mm., second—7 mm., third—3.5 mm., fourth—7 mm. One can see median and lateral spines on all femora and tibiæ and some spines on fourth metatarsi. The hair is very faintly visible on legs, but is indiscernible elsewhere.

SUB-FAMILY NEPHILINÆ.

Genus *Nephila* Leach.

Nephila pennatipes Scudder.

Scudder, Arachnida in Zittel's Handbuch der Paleontologie, 1885, Vol. I, ii, p. 744, fig. 926.

Scudder, Tertiary Insects, 1890, p. 89, Plate 11, fig. 12.

One female, No. 11651 (now No. 61) from Florissant in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is entirely correct in every detail.

SUB-FAMILY EPEIRINÆ.

This is a very large sub-family and the separation into groups and genera is based on many characters, some of which may be expected to remain preserved even in paleontological material, while others, like the difference in the structure of the inner and outer claws, certainly would not be discernible. Scudder places under the genus *Epeira* six distinct species, one specimen which is only partly preserved and several pieces with nothing but a leg on each. He also refers four species to a genus *Tethneus* established by him for these species. The history of the genus *Epeira* and its prototype *Aranea* shows how difficult it is to find permanent characters by which to distinguish the spiders referred to *Epeira* and a dozen or so of related genera. I consider it a mistaken attitude to abolish the genus *Tethneus* which after all is not applicable to recent spiders, and shall quote here the definition given by Scudder.

Genus *Tethneus* Scudder.

Spiders "compact in form, with short and stout legs of not very unequal length, and in particular the first two pairs of legs are unusually heavy. The second and fourth pairs of legs are of nearly equal length, or the second pair may be slightly longer; the femora of the first and second pairs of legs are at base as broad as or even broader than half the width of the cephalo thorax, and the longest legs are less, generally considerably less, than twice as long as the body" (p. 78).

Besides the four species described by Scudder I refer to this genus two new species.

Tethneus guyoti Scudder (*Textfigure 27*).

Scudder, Tertiary Insects, 1890, p. 78, Plate 11, figs. 8 (♂), 10 (♀).

Scudder described one female, No. 320 (now No. 91) and one male, Nos. 8265 (now No. 92) and 8311 in the Collection of the Museum of Comparative Zoology of Harvard University and one male, Nos. 1. 808 and 1. 854 in the Princeton Collection. I have examined only Nos. 320 and 8265.

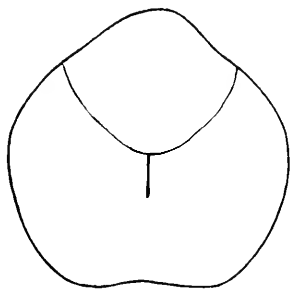

FIGURE 27.—*Tethneus guyoti* Scudder. Specimen No. 8265 (92). Carapace. × 13.

Scudder's description of the carapace is not quite correct. It is much narrowed in front (*textfigure 27*). The cephalic area is clearly separated by the cephalothoracic groove. A longitudinal groove begins at the cephalothoracic groove and runs backwards for a little over one-third of the length of the thoracic area. Neither eyes nor claws can be made out. The legs are covered with brown hair. Here and there one can see spines, but these are poorly preserved and barely discernible. The female undoubtedly presents the ventral aspect, but is so poorly preserved that nothing but the legs can be seen more or less clearly. Under such circumstances it is absolutely impossible to say whether the female belongs to the same species with the male.

The measurements given by Scudder are correct.

Tethneus obduratus Scudder.

Scudder, Tertiary Insects, 1890, p. 79, fig. 31 (♀).

One female from Florissant, No. 7177 (now No. 93) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

This specimen is very poorly preserved and the description given by Scudder, as far as can be ascertained, is correct.

Tethneus hentzii Scudder (*Textfigures 28 and 29*).

Scudder, Arachnida in Zittel's Handbuch der Paleontologie, 1885, Vol. I, ii, p. 744, fig. 928.

Scudder, Tertiary Insects, 1890, p. 80, Plate 11, fig. 14 (♂).

Scudder describes seven specimens, all males, Nos. 1226 (now No. 63), 1447 (now No. 94), 3860 (now No. 95), 6600 (now No. 96), 8635 (now No. 98) and its reverse 8533 (now No. 97), 14982 (now No. 99) and 8689, all in the Collection of the Museum of Comparative Zoology of Harvard University. Of these

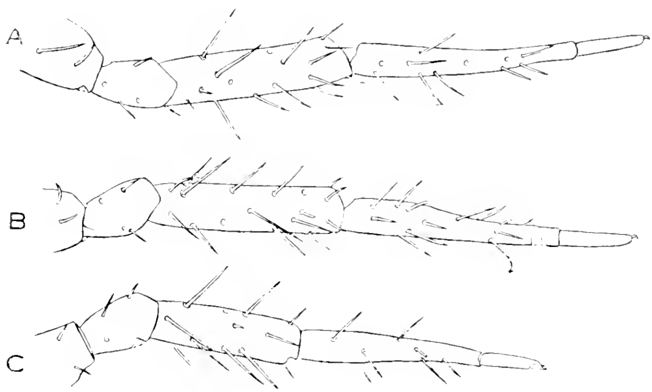

FIGURE 28.—*Tethneus hentzii* Scudder. Specimen No. 8635 (98). Legs: a, first right; b, second right; c, third right. x 10.

I have seen only specimen No. 8689. Scudder's description and measurements are correct. The best preserved specimen is that which is now numbered 97 and 98. Our *textfigure 28* shows the arrangement of spines on the first, second and third legs. The fourth leg does not possess as many spines, but as it is less perfectly preserved I refrain from giving a drawing of it. The legs are complete and show the claws. Only one claw however is really perfectly preserved. It is an upper claw of the first left leg of specimen No. 98 and is reproduced in our *textfigure 29* at a magnification of 440 diameters as drawn with the aid of an Abbe drawing apparatus.

Scudder's description of the species and his measurements are correct and I have nothing more to add to them.

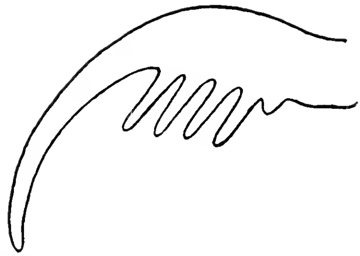

FIGURE 29.—*Tethneus hentzii* Scudder. Specimen No. 8635 (98). A claw of the first left foot. x 440.

Tethneus provectus Scudder (*Textfigure 30*).

Scudder, Tertiary Insects, 1890, p. 81, Plate 11, fig. 21 (♀).

One male and three females from Florissant, Nos. 8141 (now No. 100), 13519 (now No. 101) and its reverse 13522 (now No. 102), 14991 (now No. 103) and 13524, all in the Collection of the Museum of Comparative Zoology of Harvard University. The last mentioned specimen I have not seen.

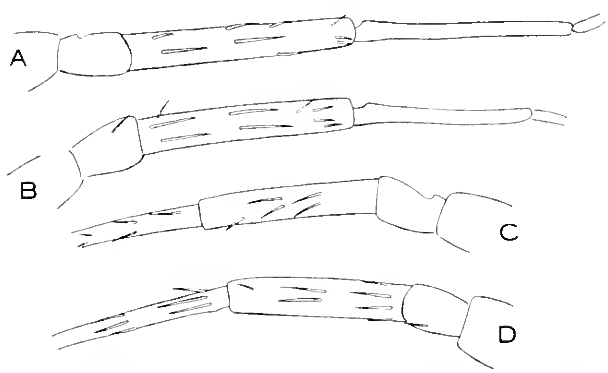

FIGURE 30.—*Tethneus provectus* Scudder. Specimen No. 14991 (103). Legs: a, first right; b, second right; c, third left; d, fourth left. x 10.

It is difficult to say whether all specimens belong to the same species. The arrangement of the spines on the legs of specimen No. 103 is shown in our *textfigure 30*. This being a male, a comparison with the preceding species is in order, and shows that *T. provectus* has not nearly as many spines as *T. hentzii,* but that its spines have a more regular arrangement. Mention must be made of the presence of hair in the area behind what Scudder described as the abdomen in specimen No. 13522. The hair covered area extends all the way to the end of the hind legs. If this area represents the actual end of the abdomen, as is very likely, then the abdomen is much longer than it is represented in Scudder's description. In every other respect his description is correct.

Tethneus twenhofeli n. sp. (*Textfigure 31*).

One male in the collection of W. H. Twenhofel of the University of Kansas.

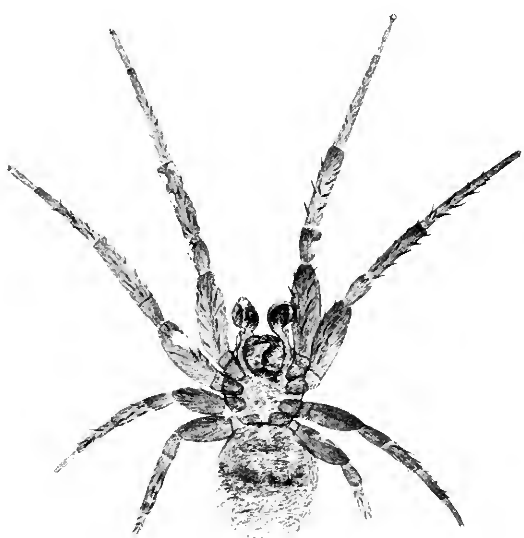

FIGURE 31.—*Tethneus twenhofeli* n. sp. x 3.33.

The specimen is fairly well preserved and presents the dorsal surface with coxæ and cheliceræ impressed on the carapace. Pedipalpi and legs are complete except for those of the fourth pair one of which is broken off across the tibia and the other across the metatarsus. The spider has a close resemblance to some recent *Epeira*, but I placed it under *Tethneus* on account of the greater size of its first and second femora as compared with those of the third and fourth leg. The abdomen is broken off near its tip and the total length of the spider may be therefore given only approximately as 7.8 mm. The carapace is longer than wide, narrower in front, widest in posterior third, with a distinct longitudinal groove. The eyes are indiscernible. An interesting feature of the two anterior pairs of legs is the considerable difference in the diameter of the end of the tibia and the base of the metatarsus. There can be no doubt that the fourth leg was longer than the third and the legs are therefore in order 1243.

Measurements of legs: First leg, femur—4 mm., tibia with patella—4 mm., metatarsus with tarsus—5 mm., total 13 mm. Second leg, femur 3.4 mm., tibia with patella—3.8 mm., metatarsus with tarsus—3.8 mm., total—11 mm. Third leg—femur—2.5 m., tibia with patella—2.5 mm., metatarsus with tarsus—2.5 mm., total—7.5 mm. Fourth leg, femur—2.6 mm., tibia with patella—2.5 mm.

There are numerous heavy spines on all legs, and legs and body are clothed with short, simple, brown hair.

The pedipalpi show a large copulatory apparatus the details of which cannot be made out but the outward appearance of which reminds that of recent Epeiridæ.

Tethneus robustus n. sp. (*Textfigure 32*).

One male from Florissant, No. 16412 (119) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

The specimen presents the dorsal surface, shows the characteristic difference in the size of the femora, but is on the whole rather poorly preserved.

Total length 6 mm. Carapace oval, slightly narrower in front than behind, 2.4 mm., long, 1.8 mm. wide. The four median eyes alone are preserved. They are round, equal in size and the quadrangle is almost square. Legs in order 1243, those of the first and second pair much heavier and provided with numerous spines. There is also simple brown hair on body and legs. The pedipalpi are rather unusually well preserved although the details naturally cannot be made out. Nevertheless one may discern in the right copulatory apparatus a deeply forked organ which probably represents both the embolus and conductor.

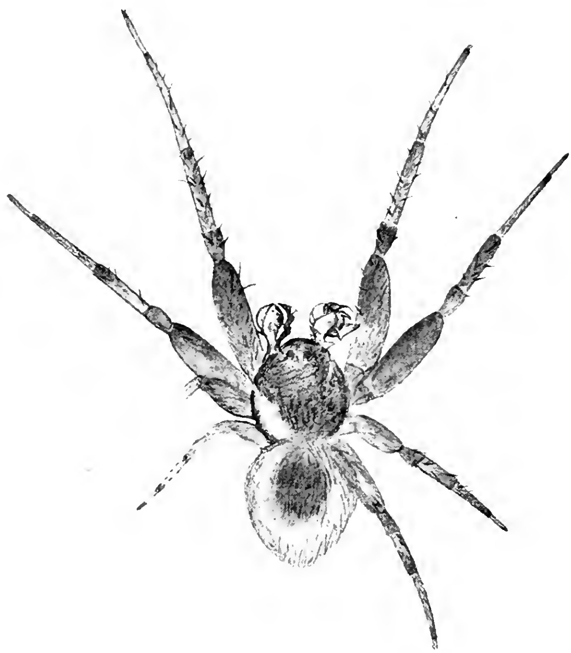

FIGURE 32.—*Tethneus robustus* n. sp. Specimen No. 16412 (119). x 5.

Measurements of legs: First leg, femur—2.7 mm., tibia with patella—3.2 mm., metatarsus with tarsus—3.9 mm., total 9.8 mm. Second leg, femur—2.5 mm., tibia with patella—2.7 mm., metatarsus with tarsus—3.1 mm., total—8.3 mm. Third leg, femur—1.4 mm., tibia with patella—1.6 mm., metatarsus with tarsus—2.0 mm., total—5.0 mm. Fourth leg, total—7.0 mm.

Genus *Epeira* Walckenaer.

Scudder has described six distinct species from Florissant and I have added two new species. All these species are undoubtedly close to recent spiders grouped under the cohors Araneus which notwithstanding the splendid efforts of the late Frederick P.

Cambridge still defies the ingenuity of arachnologists who want to split it into a series of genera.

Epeira meekei Scudder.

Scudder, Tertiary Insects, 1890, p. 83, Plate 11, figs. 2 (♀), 17 (♂).

Two males, Nos. 9211 (now No. 104) and 8221, and one female No. 3204 (now No. 105) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University. Scudder's description is correct.

Epeira abscondita Scudder.

Scudder, Tertiary Insects, 1890, p. 84, Plate 11, fig. 7 (♂).

One male from Florissant, No. 7583 (now No. 106) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is correct, but his measurements are incomplete. I have exposed all legs which are in order 1243. First leg, femur—2.8 mm., tibia with patella—3.4 mm., metatarsus with tarsus—4.3 mm., total—10.5 mm.; Second leg, femur—2.9 mm., tibia with patella—3.0 mm., metatarsus with tarsus—4.3 mm., total—10.2 mm.; Third leg, femur—2.6 mm., tibia with patella—1.8 mm., metatarsus with tarsus—2.3 mm., total—6.7 mm.; Fourth leg, femur—3.4 mm., tibia with patella—2.3 mm., metatarsus with tarsus (broken off very near its distal end)—3.1 mm., total—8.8 mm.

Epeira delita Scudder.

Scudder, Tertiary Insects, 1890, p. 85, Plate 11, fig. 6 (♂ ?).

One specimen from Florissant, No. 13523 (now No. 107) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is correct. The pedipalpi are absent, but the shape of the body and the proportion of the legs leave little doubt as to the sex of the specimen.

Epeira cinefacta Scudder.

Scudder, Tertiary Insects, 1890, p. 85, Plate 11, fig. 16 (♂).

One male from Florissant, Nos. 8576 (now No. 108) and 8806 (now No. 109).

Scudder's description is correct. The appearance of the specimen reminds one rather of recent *Mangora* than *Epeira*.

Epeira vulcanalis Scudder (*Textfigure 33*).

Scudder, Tertiary Insects, 1890, p. 86.

One male from Florissant, No. 5784 (now No. 110) in the Collection of the Museum of Comparative Zoology of Harvard University.

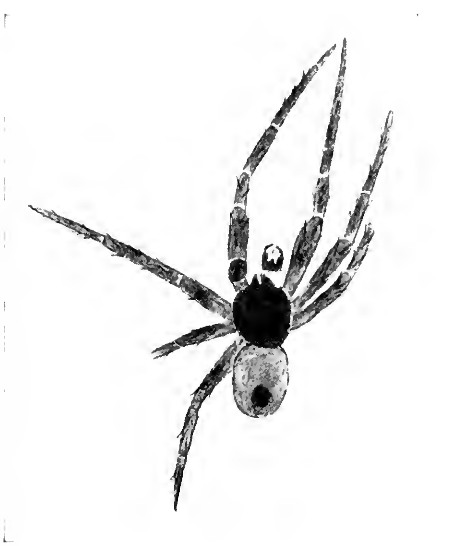

FIGURE 33.—*Epeira vulcanalis* Scudder. Specimen No. 5784 (110). x 5.

Scudder's description is correct. As he omitted to give a figure of the spider it seemed to be advisable to give one now. It may be added that the spinnerets appear as a dark brown disc a little in advance of the posterïor end of the abdomen. An interesting feature is the dark line surrounding the disc and reminding one of the circular wall around the spinnerets in recent Gasteracantha.

Epeira emertoni Scudder.

Scudder Tertiary Insects 1890, p. 87, Plate 11, figs. 15 (♂), 19 (♀).

One male, No. 8777 (now No. 111) and two females, Nos. 10998 (now No. 112) and 5117. The latter I have not seen. Specimens in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Scudder's description is correct. I am not able to decide whether the specimens represent a male and a female of the same species.

Epeira longimana n. sp. (*Textfigure 34*).

One rather poorly preserved male from Florissant, No. 16378 (now No. 123) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

The specimen is complete except for a small fraction of one chelicera and of the side of the abdomen. Total length—7.3 mm., Abdomen—4 mm. long, 3 mm. wide in its anterior third. It is typical of the shape of recent species of Epeira. The palpi are not clearly discernible, nor can the separation line between the carapace and cheliceræ be demonstrated. Although the spider represents the ventral aspect, the sternum is not discernible, nor is there any trace of the edge of the carapace. The shape of the abdomen is as represented in our figure, but at first glance one sees only the darker area. It is the presence of brown hair on the abdomen, which helps to establish the true outline of the latter. There is similar hair on the legs, together with some distinct spines. The legs are in order 1243. The characteristic feature of this species is the proportion in the length of the tibiæ of the first and second leg. As shown by the measurements these tibiæ are considerably shorter than the corresponding femora, a condition unusual in *Epeira* and possibly of a generic value.

Measurements of legs: First leg, femur—5.2 mm., tibia with patella—3.8 mm., metatarsus with tarsus—6.0 mm., total—15.0 mm.; Second leg, femur—3.8 mm., tibia with patella—2.8 mm., metatarsus with tarsus—4.2 mm., total—10.8 mm.; Third leg, femur—1.8 mm., tibia with patella—1.7 mm., metatarsus with tarsus—1.8 mm., total—5.3 mm.; Fourth leg, femur—2.7 mm.,

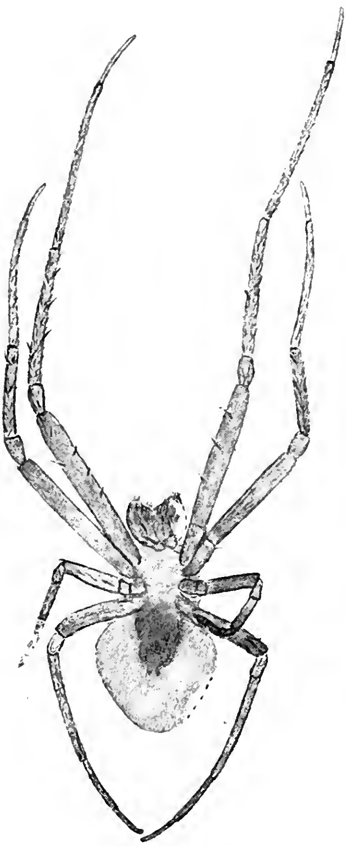

FIGURE 34.—*Epeira longimana* n. sp. Specimen No. 16378 (123). x 5.

tibia with patella—3.0 mm., metatarsus with tarsus—2.8 mm., total—8.5 mm.

Nothing else can be made out.

Epeira indistincta n. sp. (*Testfigure 35*).

One male from Florissant, No. 14986 (now No. 122) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

There seems to be little doubt as to the sex of this specimen, although the shape and size of the abdomen is rather unusual and more typical of recent females. Yet one can see two dark impressions in front of the sternum, having more the appearance of the palpal bulbs than of cheliceræ. The spider presents its ventral

FIGURE 35.—*Epeira indistincta* n. sp. Specimen No. 14986 (122). x 5.

surface and is very poorly preserved. It is the faintness of the outline of its abdomen, which induced me to give to this species the name *indistincta*. At first one sees only the darker area behind the hind femora and the spinnerets. On careful examination however one notices the true shape especially since the abdomen is clothed with very short brown hair which is more or less plainly discernible under higher power.

Total length 5.7 mm. The legs are very incompletely preserved and cannot be measured satisfactorily. It is evident, however, that their order is 1243. The first femur is heavy, the fourth longer than the first, but considerably more slender. The third femur is quite short. The legs of the third pair are bent across the abdomen. All legs are thickly covered with short hair, but there are only a few spines discernible. The spinnerets appear as a dark disc considerably in front of the posterior end of the abdomen and seem to be circumvallated as in the preceding species.

Epeira sp.

Scudder, Tertiary Insects p. 88. Plate 11, fig. 1.

An incompletely preserved specimen No. 9285 (now No. 113) from Florissant in the Collection of the Museum of Comparative Zoology of Harvard University. All that can be made out has been described by Scudder. The generic affiliation is very uncertain.

Epeira sp.

Scudder, Tertiary Insects, 1890, p. 89.

Scudder mentions this specimen, No. 63 from Green River, Wyoming. I have not seen it, but the few words which Scudder uses for its characterization are sufficient to show that the specimen is too poorly preserved to be of any value.

FAMILY LYCOSIDÆ.

Characters of the Family:—Eight eyes in three rows, all diurnal. First row composed of four small eyes. Eyes of the second row largest, directed forward, those of the third row directed upward. Posterior piece of the lorum of the petiolus emarginate in front. Trochanters notched. Claws 3.

Genus *Lycosa* Latreille.

At present the genus *Lycosa* is used by one group of Arachnologists with Simon as their spokesman for species referred by the other group to the genus *Tarentula* which two genera are therefore synonymous. On the other hand the second group uses the name *Lycosa* for spiders which Simon places under the genus *Pardosa* C. Koch. I am accustomed to follow Simon's definition.

The only spider which I refer to the genus *Lycosa* has the external appearance of recent representatives of the genus. This is, however, as far as one can go in placing the spider and in this paper I use therefore the genus *Lycosa* in an indeterminate sense.

Lycosa florissanti n. sp. (*Textfigure 36*).

One female, Nos. 10234 and 10240 in the Collection of the American Museum of Natural History.

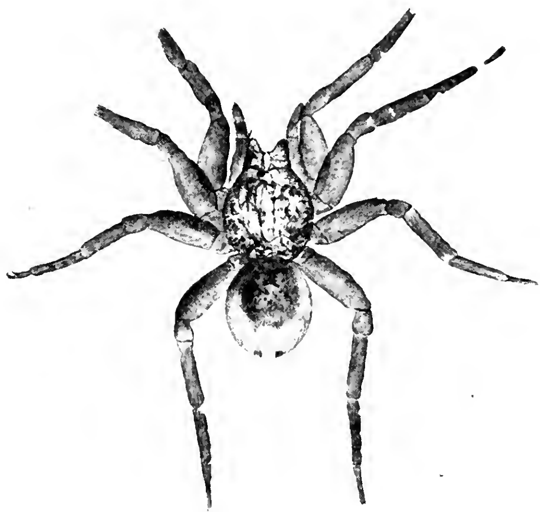

FIGURE 36.—*Lycosa florissanti* n. sp. Specimen No. 10234. x 3.33.

Except for the ends of the first and second pair of legs the specimen is complete and is well preserved. Total length including chelicerae—8.0 mm. The carapace is three mm. long, oval in shape, slightly narrowed in front. The eyes are not discernible. The abdomen is elliptic, evenly rounded in front and in the rear, 4 mm., long, 3 mm. wide. The chelicerae are powerful. On the reverse one can clearly see their entire outline, the sternum and the coxae, the posterior pair of which is contiguous. The spinnerets are visible but the details cannot be made out. The epigynum can also be seen and reminds one of the similar organ in recent species, although no detail is discernible. The third and fourth right trochanters show a notch at their distal ends. Body and legs are thickly clothed with simple brown hair. A few spines can be seen on the legs and palpi, but their arrangement cannot be determined. Measurements of legs:—First leg, femur—2.8 mm., tibia with patella—3.6 mm.; Second leg, femur 3.0 mm., tibia with patella—3.3 mm.; Third leg, femur—2.8 mm., tibia with patella—2.8 mm., metatarsus with tarsus—3.2 mm., total—8.8 mm.; Fourth leg, femur—3.0 mm., tibia with patella—3.7 mm., metatarsus with tarsus—4.0 mm., total—10.7 mm. From these measurements it would appear that the fourth leg is in all probability the longest. The femora are heavy, those of the first and second pair appreciably distended in the middle. The pedipalpi are slender, 3.0 mm. long. No claws can be seen, nor can anything more be exposed.

ORDER OPILIONES.

Characters of the order:—Abdomen segmented, broadly joined to the cephalothorax. Cheliceræ three-jointed, chelate. Pedipalpi not chelate. Coxæ of pedipalpi and of the first and second pair of legs with maxillary lobes (gnathobases). Tarsi of variable number of joints. Eyes two. Respiration by means of tracheal tubes with one pair (sometimes with two pairs) of stigmata.

The separation of the order into sub-orders is based on the relative position of the coxæ.

Genus *Phalangium* Linnaeus.

This genus belongs to the sub-order Plagiostethi of Simon, or Palpatores of Thorell. Nevertheless I am using it here in an indeterminate sense, merely as representative of the order or at best of the sub-order.

Phalangium oculatum n. sp. (*Textfigure 37*).

One specimen, No. 9494 (now No. 121) in the Scudder Collection of the Museum of Comparative Zoology of Harvard University.

Total length—3.8 mm. Abdomen 2.4 mm. wide, with a darker band in the middle and two short, pointed spines near the posterior end. Two circular eyes, separated from each other by their diameter, are situated on a transversely oval field. This field is quite flat and it is not probable that in life it had the shape of a tubercle. The cheliceræ are scarcely visible. The pedipalpi are

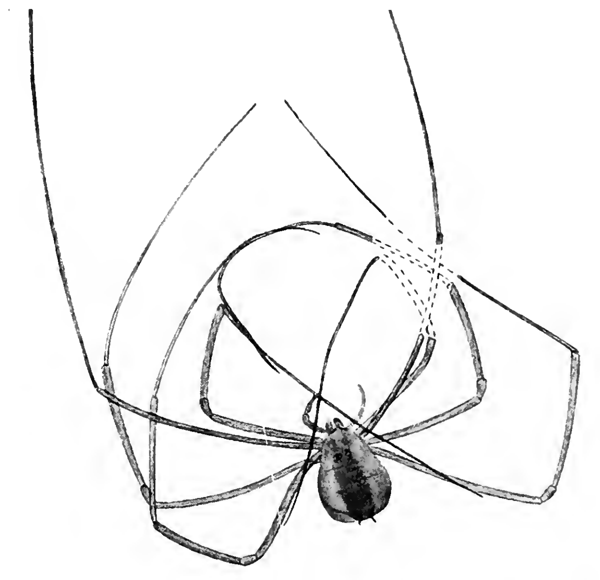

FIGURE 37.—*Phalangium oculatum* n. sp. Specimen No. 9494 (121). x 3.33.

short. The legs are very long. Those of the second pair are broken off and even in the left leg, which is more complete than the corresponding right leg, it is not possible to determine how much of the leg is missing. The right first leg is complete except for the tibia, the right third leg complete except for a piece of the metatarsus and the right fourth leg complete except for a short piece on each side of the tarso-metatarsal joint. The legs of the left side are complete except for the end of the second leg. Measurements are difficult owing to the curvature of the joints and are therefore only approximate. First leg, femur—4.7 mm., tibia with patella—4.6 mm., metatarsus with tarsus—12.6 mm., total—21.9 mm.; Second leg, femur 8.0 mm., tibia with metatarsus and tarsus (incomplete)—17.0 mm., total (incomplete) 25.0 mm.;

Figure 38.—*Phalangium lacoei* n. sp. Specimen No. 38124. x 2.5.

Third leg, femur—5.8 mm., tibia with patella—5.7 mm., metatarsus with tarsus—8.4 mm., total—19.9.; Fourth leg, femur—6.8 mm., tibia with patella—6.0 mm., metatarsus with tarsus—16.5 mm., total—29.3 mm.

It is not possible to determine the sex of the specimen.

Phalangium lacoei n. sp. (*Textfigure 38*).

One specimen No. 38124 in the R. D. Lacoe Collection of the U. S. National Museum.

This is a considerably larger species than the preceding one and reminds one greatly of the common recent species of *Liobunum*. The dorsal surface alone is visible, but no traces of segmentation can be made out. Neither are the eyes discernible. A broad median longitudinal band extends from the anterior to the posterior end of the body. The body is clothed with scattered short stout hair. The fourth legs and the left third leg are complete. The others are broken off as represented in our figure. The right second leg is misplaced in such a way that it comes to lie between the third and fourth legs, the former being directed forward. It may be recognized however by its heavier femora. Total size—6 mm., width in middle 4 mm.

First leg, femur—4.0 mm., tibia with patella—5.5 m.; Second leg, femur—6.8.; Third leg, femur—8.3 mm., remaining joints—16.2 mm., total—24.5 mm.; Fourth leg, femur—8.0 mm., remaining joints—24.0 mm., total 32.0 mm.

The sex cannot be determined and nothing else can be made out.

APPENDIX.

LEGS OF UNCERTAIN ARACHNIDS.

Scudder has described five legs representing five separate specimens, Nos. 3, 4a, 36, 4199 and 4200. He considered these fragments as belonging to some species of the genus *Epeira*. I have not seen his specimens 4a and 36. Of the other specimens No. 4199 (now No. 115) in the Collection of the Museum of Comparative Zoology of Harvard University is excellently preserved and is reproduced in our *textfigure 39*. The coxa and trochanter are missing. The femur is 6.4 mm. long with two rows of spines of about 12 spines in each row. The average length of these spines is about 0.5 mm. The patella is exceedingly short. The tibia together with the patella is 7.5 mm. long. There are two rows of about fourteen spines each on the tibia. These spines are longer than those on the femur, the third spine from the base

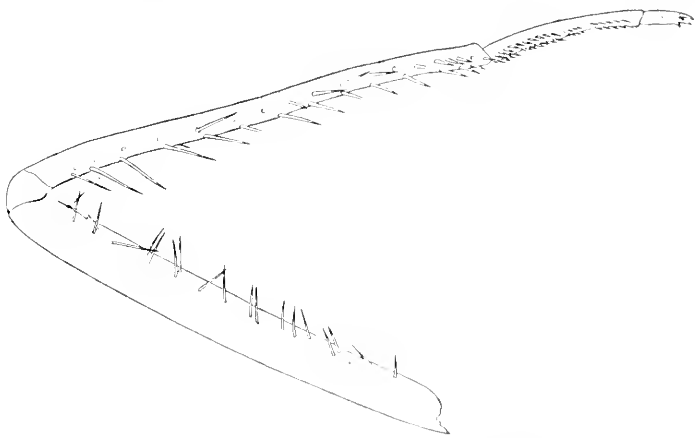

FIGURE 39.—*Leg of an Arachnid.* Specimen No. 4100 (115). x 10.

measuring 1.0 mm. Several spines of one of the rows are missing, but their bases of attachment are clearly discernible. The metatarsus is slightly curved 2.3 mm. long with two rows of about 20 spines each, the spines being very short. The tarsus is only 0.7 mm. long, without spines but with two terminal claws. Each claw is smooth, but with a basal, short, conical tooth. There is no trace of hair on the leg.

The leg is plainly not that of an *Epeira*, nor do I know of any spider with an arrangement of spines similar to this, for these spines are distinctly limited to the ventral surface. The other two specimens, now Nos. 114 and 116, are not complete, but apparently belong to the same species.

COCOONS OF SPIDERS.

Scudder has described and figured cocoons of spiders, referred by him to the species *Aranea columbiae*. (Tertiary Insects, 1890, p. 71, Plate 2, figs. 1 and 2.) I have not seen his specimens, but judging from his description and figures one would suspect that the cocoons in question belong to more than one species. It would of course be impossible to determine the species.

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TRANSACTIONS OF
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Professor Emeritus of the English Language and Literature in Yale University.

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ABBREVIATIONS

The following titles are cited by the name or abbreviation which occurs first in the line:

Bönhoff, *Aldhelm von Malmesbury.*

Brandl, *Geschichte der Altenglischen Literatur.* (Paul's *Grundriss der Germanischen Philologie,* 2d ed.)

Bright, *Chapters of Early English Church History.* Oxford, 1898.

Brooke, *History of Early English Literature.*

Chadwick, *The Heroic Age.*

Chambers, *Beowulf,* ed. Wyatt and Chambers.

Dottin, *The Gaelic Literature of Ireland,* tr. Dunn. Washington, 1906. (Privately printed.)

Eckenstein, *Woman under Monasticism.*

Eddi (Eddius Stephanus), *Vita Wilfridi Episcopi.* (*Historians of the Church of York,* Vol. 1.)

Ehwald, ed., *Aldhelmi Opera.* (*Mon. Germ. Hist.*)

Freeman, *History of the Norman Conquest,* Vol. 1.

Giles, ed., *Sancti Aldhelmi Opera.*

Green, *Making of England.*

Haddan and Stubbs, *Councils and Ecclesiastical Documents.*

Hahn, *Bonifaz und Lul.*

Healy, *Insula Sanctorum et Doctorum, or, Ireland's Ancient Schools and Scholars,* 5th ed.

Hyde, *Literary History of Ireland.*

Joyce, *Social History of Ancient Ireland.*

Lappenberg, *History of England under the Anglo-Saxon Kings,* tr. Thorpe, new ed.

Lingard, *History and Antiquities of the Anglo-Saxon Church.* London, 1858.

Manitius, in *Sitzungsberichte der Phil.-Hist. Classe der Kais. Akad. der Wissenschaften,* Vol. 112. Vienna, 1886.

Montalembert, *Monks of the West.*

Murray, *Handbook for Yorkshire.* London, 1874.

Norway, *Highways and Byways in Yorkshire.*

Oman, *England before the Norman Conquest.*

Phillips, *Illustrations of the Geology of Yorkshire,* Part I, 2d ed.

Plummer, ed., *Bædæ Opera Historica.*

Ramsay, *Foundations of England.*

Reeves, ed., *Life of St. Columba, written by Adamnan.* Edinburgh, 1874.

Ten Brink, *Beowulf.*

White, *A Month in Yorkshire.*

William of Malmesbury, *Gesta Pontificum,* Vol. 5.

Eccl. Hist. = Bede, *Ecclesiastical History of the English People.*

Sax. Chr. = (*Anglo-*) *Saxon Chronicle.*

The Latinizing *d*, in proper names like Wilfrid, is consistently restored to *th,* representing the Old English original, even in direct quotations.

THE POSSIBLE BEGETTER OF THE OLD ENGLISH *BEOWULF* AND *WIDSITH*

I. NORTHUMBRIA IN THE SEVENTH CENTURY

The seventh century was a glorious era for Northumbria. The two kingdoms of Deira and Bernicia, the southern and the northern, were united by the Bernician king, Æthelric, in 588. To him succeeded his son, Æthelfrith, in 593. At this time, of the three great provinces of Britain—Kent, Northumbria, and Mercia—it was Kent that was the most powerful. But soon Northumbria began to rise into prominence. Æthelfrith won a signal victory over the forces of the united Irish and Welsh in 603 at Degsastan, probably just north of the Scottish border; and the resistance of the Welsh to the Northumbrians was completely overcome at the battle of Chester in 614. On the death of Æthelfrith in 617, Edwin, of the rival house of Deira, became the ruler of the two provinces, being then thirty-two years of age. Five years afterward he had become the sovereign or overlord of all England save only Kent; and the king of Kent was his brother-in-law after 625. In 627 he made a profession of Christianity, under the influence of his wife, Æthelberg, and the Roman missionary of the north, Paulinus. This conversion, however, at once roused the enmity of the heathen English, and Edwin was finally slain by the Mercians under the ferocious Penda in 622. After an interval of a year, the sovereignty of Northumbria passed over to Bernicia in the person of Oswald, who, after a residence in Iona, and perhaps Ireland,[1] assumed the rule over Northumbria in 634. At the battle of Heavenfield, now St. Oswald's, seven or eight miles north of Hexham, he gained a decisive victory over the Welsh in 635. It was he who brought Aidan into Northumbria, and established his as Bishop of Lindisfarne. Like Edwin, though perhaps less effectually, Oswald held the primacy of England, and was even known as 'emperor of the whole of Britain.'[2] He, too, fell in battle against the same Mercian king, Penda, from whom Edwin had met his doom. This was in 642, after a reign of eight years.

---

[1] Plummer 2. 99.

[2] Reeves, p. 113.

The leadership of Northumbria, now much oppressed by the victorious Penda, continued in the northern line, the next notable king being Oswy, brother of Oswald, who, like him, had been converted in Iona. After the death of the Deiran Oswin in 651, and of a successor about whom history has little to say, Oswy became king of all Northumbria by the battle of the Winwæd, in which Penda was slain, and so continued from 655 to 671, for the first part of this time being supreme throughout England. A rebellion of the Mercians, which began in 659, somewhat abridged the power of Northumbria, without, however, much affecting its internal strength and prosperity. In 664, at the famous Synod of Whitby, the king, who, according to Bede,[1] had been 'instructed and baptized by the Irish, was very perfectly skilled in their language, and thought nothing better than what they taught,' found their contentions at length overruled by the arguments of Wilfrith; and thus England, by a decisive act, cast in her lot with the Christians of the Continent, instead of remaining markedly provincial. Oswy was succeeded by his son Ecgfrith, who ruled Northumbria from 671 to 685. In 671-2 he put down a rising of the Picts, and by 675 had entered upon a war with Mercia, which, having steadily grown in power for sixteen years, now undertook to throw off the Northumbrian yoke, though, as the event proved, without success. Four years later the struggle was renewed, without seriously affecting the balance of power, though Mercia gained a certain advantage. In 684 Ecgfrith sent his general, Berht, with an army to attack Ireland, and, according to Bede,[2] 'miserably wasted that harmless nation,[3] insomuch that in their hostile rage they spared not even the churches and monasteries,' the region devastated being the eastern portion of county Meath.[4] In the next year, 685, Ecgfrith fell in battle against the Picts at Dunnichen, near Forfar, and, according to Simeon of Durham, was buried in Iona. But the story of Ecgfrith would be incomplete without including such events as his share in the foundation of Jarrow,[5] the future home of Bede, in the last years of his

[1] *Eccl. Hist.* 3. 25.
[2] *Eccl. Hist.* 4. 26.
[3] Cf. Wm. Malm., *Gest. Reg.* 1. 1. § 51.
[4] 'The Irish coast from Dublin to Drogheda' (Rhys, *Celtic Britain*, p. 169).
[5] Plummer 1. xi, note 2; 1. 370; 2. 361.

life; the poetic achievement of Cædmon (unless that belongs, in whole or in part, to the reign of his father Oswy); and the activity of Theodore of Tarsus, which, though affecting beneficially the whole of England, wielded an especially marked influence upon Northumbria.

II. CHRONOLOGY OF ALDFRITH'S LIFE

Thus briefly we have sketched the history of Northumbria for a hundred years, preparatory to considering its next prince, Aldfrith, the son, by an Irish mother, of Oswy, and the elder brother of Ecgfrith. The period upon which we are entering has been thus characterized by Plummer[1]: 'The defeat and death of Ecgfrith in the fatal battle of Nechtansmere in 685—Bede's thirteenth year—marked the beginning of Northumbrian decline. Ecgfrith was succeeded by his half-brother Aldfrith, a learned and pious prince, who ruled over a diminished territory with fair success. But after his death in 705, usurpation, conspiracy, and murder make up the dismal tale of Northumbrian rule.' The especial significance of Aldfrith's reign is more fully brought out by Green[2]:

> The fall of Ecgfrith in 685 had shaken indeed the fabric of the [Northumbrian] realm, for the triumphant Picts pressed in upon it from the north, . . . while their success woke the Britons to fresh revolt. Aldfrith, however, a brother of Ecgfrith, who was called from a refuge at Hii [Iona] to the Northumbrian throne, showed himself in this hour of need worthy of the blood from which he sprang by reasserting his mastery over the men of Cumbria and Galloway, and exchanging the claim of lordship over the Picts for a profitable alliance with them. Even in the north, however, his work was limited within the bounds of self-defense; and a consciousness of weakness is seen in the change which passes over the policy of his realm. All effort at conquest was for a while abandoned; and the state which had won England by its sword from heathendom, and given her by its victories the first notion of a national unity, turned to bestow on her the more peaceful gifts of art, letters, and a new poetry. The twenty years of Aldfrith's rule were years of peace and order, in which the literary and artistic impulse which had been given to Northumbria alike by the Celtic and Roman churches produced striking results. Letters above all sprang vigorously to the front. The books which Benedict brought from Rome in visit

[1] I. xxxiii.

[2] Pp. 396-7.

> after visit quickened the intellectual temper of the country; and it is not too much to say that under Aldfrith, himself a man of learning and study, Northumbria became the literary centre of Western Europe.

In what follows we shall devote ourselves chiefly to the illustration of the last sentence quoted, but it will first be necessary to consider the chronology of Aldfrith's life, in so far as it can be ascertained by a combination of the facts at our disposal. The dates of his accession and death are known with sufficient accuracy, the former being determined by that of Ecgfrith's death, which, according to Bede,[1] was May 21, 685, and the latter by that in the *Saxon Chronicle*, which is Dec. 14, 705. The date of his birth is not so easily fixed, even approximately. William of Malmesbury distinctly states[2] that he was older than Ecgfrith; but Bede says that Ecgfrith was in his fortieth year when he was slain in 685. Accordingly, Ecgfrith would have been born in 645, or before May 21, 646 at latest; and Aldfrith, being older, would of course have been born in an earlier year. The passage from William of Malmesbury is as follows:

> While a more than common report everywhere noised the death of Ecgfrith, an intimation of it, 'borne on the wings of haste,'[3] reached the ears of his brother Aldfrith. Though the elder brother, he had been deemed by the nobility unworthy of the government, because of his illegitimacy,[4] . . . and had retired to Ireland, either through compulsion or indignation. In this place, safe from the hatred of his brother,[5] he had, from his ample leisure, become versed in literature, and had enriched his mind with all philosophy.[6] On this account, the

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[1] *Eccl. Hist.* 4. 26.

[2] *Gest. Reg.* 1. 1. § 52.

[3] Juvenal 4. 149.

[4] Bede calls him 'nothus' (Plummer 2. 263); similarly Ælfric, *Hom.* 2. 148: 'His cyfesborena brōðor siððan rīxode, se ðe for wīsdōme wende tō Scottum, þæt hē ælðēodig on lāre geðuge.'

[5] Plummer (2. 263) says: 'Ecgfrith had wished to make him a bishop [cf. Ten Brink, *Beowulf*, p. 227], perhaps with the idea of excluding him from the succession to the crown, but he declined on the ground of his unworthiness; Vita Anon., and Vita Cudb. *u. s.*' [chap. 24]; but Bede is clearly referring to Cuthbert, not to Aldfrith. For Cuthbert's reluctance to be made a bishop, see also *Eccl. Hist.* 4. 28. He was not elected till 684, nor consecrated till March 26, 685, less than two months before Ecgfrith's demise.

[6] 'Philosophy' is probably to be here taken in the sense of 'theological learning.'

very persons who had formerly banished him, now esteeming him the better qualified to manage the reins of government, sent for him of their own accord.

The mother of Ecgfrith, Eanfled, was born April 20, 626[1]; and Oswy, who died Feb. 25, 671,[2] in his fifty-eighth year, must probably have been born in 613. They were married after Oswy had become king,[3] which was in 642, and of course, as we have seen above, before August, 645. In 642 Oswy would have been twenty-nine years of age, and in 645 thirty-two. It is not surprising, then, considering the manners of the period, and especially the temptations of princes, if he had an illegitimate son before that time; nor, considering his long residence among the Irish,[4] that this son should have been the offspring of a connection with a daughter, Fina, of the Irish princely house of Niall.[5]

On the death of Edwin, Oct. 12, 633, Oswy and his brothers were permitted to return from the exile among the Irish and Picts to which they had been forced at Edwin's accession[6]; at this time Oswy would have been scarcely more than twenty years of age, and the son born in Ireland, supposing Oswy to have returned to England at once, would have seen the light as early as 633; but as Oswald reigned until Aug. 5, 642, and has been suspected of compassing the death of Eadfrith,[7] Edwin's son, and of threatening the life of a grandson and another son of Edwin,[8] perhaps we

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[1] *Eccl. Hist.* 2. 9.

[2] Oman, p. 293; Plummer 2. 211.

[3] *Eccl. Hist.* 3. 15.

[4] *Sax. Chr.* 617; *Eccl. Hist.* 3. 1.

[5] Reeves, p. 284; Plummer 2. 263.

For the marriage of Oswy's brother, Eanfrith, with a Pictish princess during his exile, see Oman, pp. 294, 307; Plummer 2. 120. For the possibility that Oswy himself may have been illegitimate, see Plummer 2. 161. Oswy's daughter, Alhfled, married Peada, son of Penda, in 653, so that she can hardly have been the fruit of a union contracted in 642 or later (cf. Plummer 2. 175); her mother may well have been that Riemmelth, daughter of Royth, son of Rum, whom Nennius characterizes as one of Oswy's wives, and 'whose name suggests a Pictish origin' (*Dict. Nat. Biog.* 42. 336).

[6] *Eccl. Hist.* 3. 1. The banished brothers were (*Sax. Chron.* 617) *Eanfrith, Oswald, Oswy*, Oslac, Oswudu, Oslaf, Offa (kings of Northumbria in italic).

[7] *Eccl. Hist.* 2. 20; Plummer 2. 116.

[8] *Eccl. Hist.* 2. 20.

may suppose that Oswy judged it expedient to remain in Ireland, if not till his accession in 642, at least for a considerable period after 633.[1] In this case, Aldfrith might conceivably have been born as late as 642. If, on the other hand, Oswy brought his Irish concubine with him to England, Aldfrith may have been born later, though hardly after Oswy's marriage, since the object of that seems to have been political,[2] and the Christian spirit of Eanfled and her Kentish relatives would hardly have been conciliated by the presence of an alien mistress. On these grounds, then, we should place Aldfrith's birth not later than 642.[3]

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[1] However, William of Malmesbury explicitly says (*Gest. Reg.* 1. 1. § 49) that, at the death of Edwin, 'Oswald and Oswy, now grown up, and in the budding prime of youth, resought their country,' and adds that the same was true of their elder brother, Eanfrith.

[2] Green, p. 296.

[3] Montalembert (4. 67, note 1): 'Aldfrith was a natural son, and probably the eldest of Oswy's children.' Plummer (2. 264) inclines to think that Aldfrith was younger than Ecgfrith, citing from Bede's *Vit. Metr. Cudb* (21. 51-2) these lines as referring to Aldfrith:

> Utque novus Josia, fideque animoque magis quam
> Annis maturus, nostrum regit inclitus orbem.

But, as Josiah ascended the throne at the age of eight, and reigned thirty-one years, it would be difficult to make out how Bede, writing before 705, when Aldfrith died (cf. Plummer 1. cxlvi), could refer to the king as a 'modern Josiah, mature in faith and soul rather than in years.' And in fact Bede was referring to Aldfrith's son, Osred, who did actually succeed his father at the age of eight (see p. 291, note 4); and, since Osred had not yet become the prodigy of wickedness into which he had developed before his death at the age of nineteen, Bede must have been writing in 706, the year of the Synod of the Nidd, or soon after. Folcard, in his life of John of Beverley, has a good word for Osred at the time of the synod, calling him (*Hist. of the Church of York* 1. 254) 'a man of piety and faith.' Æthelwulf, writing a century later than his reign, intimates that Osred at least began well. Aldfrith, says the poet (Simeon of Durham, ed. Arnold, 1. 267-8),

> natum genuit, qui nomine clarus
> Gentibus enituit, Saxonum regmina servans
> Gestis et verbis, et omni strenuus actu
> Exstitit a primis, sed non moderatus, in annis.

The whole matter becomes clear when Bede's lines (*Op. Hist. Min.*, ed. Stevenson, p. 25) are read with attention; between his account of Aldfrith (see p. 320, note 2) and the two lines quoted above occur these two (for *Tyrio . . . ostro* see Virgil, *G.* 3. 17; Horace, *A. P.* 228):

But there are other considerations which bear upon this point. These grow out of the intimate relations which subsisted between Aldfrith and the celebrated Aldhelm of Malmesbury. The grounds and proofs of their intimacy are these. In the first place, they were both of royal blood: Aldfrith, we have seen, was the son of the Northumbrian monarch, Oswy, while Aldhelm's father was Centwine,[1] who ruled over Wessex from 676 to 685.[2] Then the two were related by marriage, Centwine having wedded a sister[3] of Ecgfrith's second wife, Eormanburh, while Aldfrith espoused Cuthburh,[4] a sister of Ini, who was king of Wessex from 688 to 725. Thirdly, both had come under the influence of Irish teachers—Aldfrith in Ireland itself, and Aldhelm under the hermit

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Hujus nunc Tyrio venerabile pignus in ostro
Jure datas patrio sceptri jam tractat habenas,

where the youthful Osred is presumably 'reverend' only in his regal capacity.

[1] Freeman, in *Somerset Arch. Soc. Journal*, 18. 2. 14, note; 20. 2. 24-6; Bönhoff, p. 35; Manitius, *Gesch. der Lat. Lit. des Mittelalters*, p. 134; but see *Dict. Nat. Biog.* 9. 422-3 (forgetting p. 245); Ehwald, p. XI. Cynegils (d. 643), father of Centwine, could not have been born later than 597, when his father died, nor Centwine later than 643, though probably many years earlier, since Cynegils was not less than 46 at his own death, and came to the throne 32 years earlier than that. If Centwine had been born in the year of his father's accession, or within several years thereafter, he might, by a first wife (see Freeman, p. 24), have been the father of Aldhelm.

[2] *Sax. Chron.* 676, 685; Lappenberg 1. 321-4; Wm. Malm., *Gest. Pont.*, p. 352; Giles, pp. 115-117; Montalembert 4. 291.

[3] Eddi, chap. 40; Bright, p. 302. Lingard (1. 125) calls her Irmenigild.

[4] *Sax. Chr.* 718; Wm. Malm., *Gest. Reg.* 1. 1. § 35; Montalembert 4. 408-9. They separated, no doubt by mutual consent, in order, apparently, that Cuthburh might enter the convent at Barking, where, as a matter of fact, she was when Aldhelm addressed his prose treatise on Virginity to the abbess and nuns of that house (Giles, p. 1; Eckenstein, p. 113). In 705 we find her as abbess of Wimborne (*Cartularium Saxonicum* 1. 168; Giles, p. 351; Eckenstein, p. 116, according to whom she died between 720 and 730, probably before 725). She can hardly have left Aldfrith before 797, when her son Osred was born (*Eccl. Hist.* 5. 18), nor even then, since another son, Offa (*Dict. Chr. Biog.* 4. 67; Oman, p. 325), was probably younger than Osred; Osric, who reigned from 718 to 729, may have been yet another son (Plummer 2. 337-8; Simeon of Durham, ed. Arnold, 1. 39; Oman, p. 325), though he was possibly a half-brother of Osred, as Plummer suggests.

It is to the bonds of relationship referred to in the text that Aldhelm may be supposed to refer in the phrase, 'domesticæ familiaritatis fiducia fretus' (Giles, p. 228).

Mailduf,[1] from whom the future Malmesbury was to be named. Finally, two letters, or rather a letter and a treatise, both addressed by Aldhelm to Aldfrith, attest and confirm their close friendship.

Aldhelm and Aldfrith seem to have been about of an age, as we shall now attempt to show. We have the explicit statement of William of Malmesbury[2] that Aldhelm was not less than seventy years old at his death on May 25, 709; consequently, we have no reason to suppose that he was born after May 25, 639. The reasons for assuming that Aldfrith was of about the same age we will now consider. They are drawn from the two letters referred to above, known respectively as the *Epistle to Eahfrith*[3] and the *Epistle to Acircius*[4]—these having been separated by a considerable space of time.

The former of these epistles was written on Aldfrith's return from exile in Ireland, or at least from a six years' residence in that country, where he had been engaged in study ('ex Hiberniæ brumosis circionis insulæ climatibus, ubi ter bino circiter annorum circulo uber sofiæ sugens metabatur'[5]). This return can hardly have been that of 685, when he was called to the throne of Northumbria, as has sometimes been assumed,[6] since, as he had resorted to Ireland on the accession of Ecgfrith, and the interval between that and the death of Ecgfrith was fourteen years, the six years of which Aldhelm speaks would have begun in 679, instead of 671. We can only suppose, then, that there must have been more than one return from Ireland, and it is the simplest hypothesis to assume that, on some express permission from Ecgfrith, he revisited England in 677, whence, after a season, he again

[1] Plummer 2. 310.

[2] *Gest. Pont.*, p. 332 (but cf. p. 385): 'Aldhelmus non minor decedens septuagenario'; cf. Giles, p. xvii, who says, 'consequently he must have been born in A. D. 639, or earlier'; Plummer says (2. 309) 'about 639.'

[3] Ehwald (p. 487) denies that Eahfrith = Aldfrith; but cf. his pp. XIX, 61, and note 6, below.

[4] 'Eahfrith' is an unaccountable spelling for 'Ealdfrith'; 'Acircius' is to be interpreted in the light of the Latin *circius*, 'west-northwest wind,' so that when Aldhelm sends his letter (Giles, p. 216) 'illustri Acircio, Aquilonalis imperii sceptra gubernanti,' he may be understood as addressing Aldfrith as the king of the North (Northumbria) who had come from the West (Ireland) or Northwest (as it would have been from Aldhelm's Wessex); see Ehwald 1. 61; Hahn, p. 22, note 1; and cf. Dan. 11. 13 ff.

[5] Giles, pp. 91-2; Ehwald, p. 489.

[6] For example, Hahn, p. 6, note 3; Bönhoff (p. 100) says 682-4.

returned to the land of his exile or his choice. There is another reason for placing the visit to England at an earlier date than 685, which is that, while in his second letter Aldhelm addresses his correspondent as king, in this he exhorts him, in the capacity of a man of learning, to render his treasures of knowledge accessible to others ('aperito gurgitem, et sitientia rigato arva mentium'[1]), and actually applies to him the word 'teacher' ('præceptoris vocamine'[2]). In fact, since Aldfrith bore the double character of philosopher and king,[3] which Plato[4] desired to see united in the same person, it is in the former of these aspects that Aldhelm is here regarding him.[5] Once in each of these letters he rather pointedly calls Aldfrith's attention to Solomon,[6] in each case alluding to the significance of his name, perhaps by way of delicate flattery—*frið* of course meaning 'peace.'[7]

The second letter, being addressed to Aldfrith as king, must have been written between 685 and 705. In the opening sentence,[8] the association of Aldhelm and Aldfrith in earlier life is

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[1] Giles 93. 17.

[2] Giles 92. 14; cf. Bönhoff, p. 100.

[3] So Alcuin, *De Pontificibus* 843-5:

> Qui sacris fuerat studiis imbutus ab annis
> Ætatis primæ; valido sermone sophista;
> Acer et ingenio; idem rex simul atque magister.

[4] *Rep.* 473 D; see Plummer 2. 332, and add Alcuin (*Epist.* 101) to Charlemagne.

[5] Bede twice calls him 'vir doctissimus' (*Eccl. Hist.* 4. 26; 5. 12), and Eddi twice calls him 'sapientissimus' (chaps. 44, 59), the second time implying wisdom rather than learning. In Irish writings he is called (Plummer 2. 263) 'the wondrous sage, Adamnan's (624-703 or 704) pupil,' and 'Erin's chief sage of learning.'

[6] Giles, pp. 93, 219.

[7] Cf. Plummer 2. 312. The anonymous life of Cuthbert (chap. 28) speaks of Aldfrith, 'qui nunc regnat *pacifice*.'

[8] This sentence is as follows (Giles, p. 216; Ehwald, pp. 61-2): 'Non ambigo, reverentissime fili, sed, profundæ credulitatis frena relaxans, confido quod provida sagacitatis vestræ præcordia reminiscantur, nos ante bis bina lustrorum volumina inextricabile conglutinati fœderis pignus pepigisse, et spiritali sodalitatis vinculo devotæ caritatis contubernia copulasse; nam, pridem, tempore pubertatis nostræ, cum septiformi spiritalium charismatum munificentia vestra solers indolis sub manu venerandi pontificis ornaretur, paternum memini me nomen adeptum, teque adoptivæ dignitatis vocabula cum cælestis gratiæ prærogativa sortitum.' An approximate translation

referred to, one bond at least growing out of the baptism of Aldfrith, where Aldhelm was present as sponsor; but it is uncertain whether this, or a later association of the two, is described as having occurred a score of years earlier than the date of the letter. If this was written in 690, or soon after, the date of twenty years earlier might be that of their study together under Theodore and

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might be: 'I am in no doubt whatever, my revered son, for, giving the rein to my unquestioning belief, I am assured that the liveliness of your intellect will recall how we, now some four periods of lustres ago, knit the inextricable pledge of an indissoluble covenant, and, by the spiritual bond of fellowship, established the intimacy of devoted affection; for when, now long ago, in the time of our earliest manhood, your talents were adorned by the sevenfold bounty of spiritual gifts at the hands of the venerable bishop, I remember that I received the name of father, and that you obtained the designation of adoptive dignity, along with the prerogative of heavenly grace.' Or, condensing it to something like its lowest terms: 'I am sure you will remember how, twenty years ago, we established ties of close friendship; for, as I stood sponsor for you at your baptism and confirmation, when you received the sevenfold gift of the Spirit, we became spiritually related as father and son.' Whether we are to assume that the bond created by sponsorship was an earlier one, and was afterward strengthened by their close association as fellow-students, will depend upon the precise meaning we assign to *pridem* (above), which once in Aldhelm appears in *pridemquam* (Ehwald 302.6)=*pridie quam*, *antequam*. This might suggest a meaning 'previously' for *pridem*. That the 'spiritali sodalitatis vinculo' need not refer to the sponsorship appears from 'a sodali contubernio vestro' of his letter to Hadrian (Ehwald, p. 478; Giles, p. 330). More decisive is the phrase of William of Malmesbury (*Gest. Pont.*, p. 376), where, referring to Aldhelm in relation to Berhtwald (see p. 309, note 5), he calls him 'veteris contubernii sodalem, nam et pariter litteris studuerant,' etc.

For the sevenfold gift of the Spirit, compare the prayer of confirmation, as given in the Pontifical of Archbishop Egbert (d. 766), and translated by Lingard (1. 297): 'Almighty and everlasting God, who hast granted to this thy servant to be born again of water and the Holy Ghost, and hast given to him remission of his sins, send down upon him thy sevenfold Holy Spirit, the Paraclete from heaven, *Amen*. Give to him the spirit of wisdom and understanding, *Amen;* the spirit of counsel and fortitude, *Amen;* the spirit of knowledge and piety, *Amen*. Fill him with the spirit of the fear of God and our Lord Jesus Christ, and mercifully sign him with the sign of thy holy cross for life eternal.' The eves of Easter and of Whitsuntide were the regular times for the administration of baptism (Lingard 1. 291; Plummer 2. 95-6). In the primitive church, confirmation followed immediately on baptism (Plummer 2. 382); in this case there may be a doubt, since, though the sevenfold gift implies the rite of confirmation, the sponsorship which carries with it the relation of godfather and godson might have

Hadrian[1]—with whom at least Aldhelm did study—in which case the baptism might have been some years previous; if it is the baptism that Aldhelm refers to as twenty years earlier, the letter could hardly have been written much after 685. In 665 Aldhelm would have been twenty-six years old, and the 'tempore pubertatis nostræ' might indicate no more than that Aldhelm was of the statutory age required in a sponsor; but in any case the phrase suggests something like an equality of age between the two men.[2]

The result, then, of our scrutiny of Aldhelm's two letters to

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been that of confirmation, not that of baptism, since there might be different sponsors for each (Plummer 2. 383; Haddan and Stubbs 3. 193: 4. 8). 'Son of adoption' was used by Asser (*Life of Alfred*, ed. Stevenson, p. 47) of Guthrum's relation to King Alfred, at the baptism of the former in 878: 'Quem Ælfred rex in filium adoptionis sibi suscipiens, de fonte sacro baptismatis elevavit.' A deacon was sometimes chosen as sponsor (*Dict. Chr. Biog.* 2. 1924), so this possibility is not excluded with respect to Aldhelm. For the requirement with respect to the age of puberty, see the *Realencyc. f. Prot. Theol. u. Kirche* 19. 449; for sponsors in the case of adults, *ibid.* 19. 447.

[1] Almost certainly, if at all, in 670, since the Canterbury school can hardly have begun before that year, and the banishment of Aldfrith would probably have occurred soon after his father's death on Feb. 25, 671.

[2] When Aldhelm, in writing to Aldfrith, refers to the relation of father and son, as in the phrase 'præstantissime et amantissime fili' (Giles, p. 228), or 'paterna sollicitudine coactus' (Giles, p. 328), he is always, presumably, referring to his sponsorship; though Bede, it may be remarked, when still under thirty, addressed his fellow-deacon, Cuthbert, as 'dulcissime fili' (Plummer 1. cxlv); and Oswald first became sponsor for Cynegils in 635, and then married his daughter (*Sax. Chr.; Eccl. Hist.* 3. 7). But, as is natural, Aldhelm stresses the fraternal relation elsewhere: 'sodalitatis fraternæ cliens' (Giles, p. 91); 'fraternæ ironia dilectionis' (Giles, p. 95); 'priscæ fraternitatis memor' (Giles, p. 228). In particular, he explains that he writes the second letter to Aldfrith to revive their fraternal affection ('pristini fraternitatis affectus'), though assured, for his own part, that neither time nor space can diminish perfect love (Giles, p. 228).

Aldhelm's 'tempore pubertatis nostræ' is probably to be taken in a rather loose sense, if we may judge from the 'infantiæ' in the heading of his letter to Hadrian in 674 or 675 (Giles, p. 330), in which he refers to his correspondent as the teacher of his untrained childhood ('rudis infantiæ . . . præceptori'), Hadrian having reached England only four or five years before. By a strict interpretation of 'infantiæ,' Aldhelm would have been only seven years old in 670; yet he was abbot of Malmesbury in 675, after having been ordained priest, probably at or beyond the canonical age of thirty (Giles, p. 359; cf. Bönhoff, pp. 55, 56, 100, 104).

Aldfrith is the conclusion that the two men were approximately of the same age, with Aldhelm probably a little the elder. But we had already seen that Aldhelm was born not later than 639, and Aldfrith not much, if any, later than 642. Closer to the truth than this we shall hardly be able to arrive.

III. ALDFRITH'S QUALIFICATIONS AS A PATRON OF LITERATURE

We have now to consider Aldfrith's qualifications for presiding over a court where learning and literature should flourish. His own learning seems to have been chiefly acquired in Ireland, and perhaps Iona. Bede, in his prose life of Cuthbert (chap. 24), is not very explicit with regard to Aldfrith's place of sojourn, but says he 'was then living as an exile in the Irish islands, in order to gratify his love for literature'; and a little later remarks that 'he had been devoting himself for not a few years[1] ('non paucis antea temporibus') to reading in the regions of the Irish, having endured voluntary exile for his love of wisdom.[2] These 'regions' and 'islands' of the Irish are rather vague,[3] and might be interpreted to cover Iona for at least part of the time, since Bede always considers that island as belonging to Ireland.[4] Plummer[5] is clear that, on the death of Ecgfrith, Aldfrith's return to England was from Iona, on the strength of the sentence in the anonymous life of Cuthbert (chap. 28): 'He was at this time in the island which they call Iona.'

Aldfrith's resort to Ireland for study was by no means unexampled. In fact, during the second half of the seventh century, especially until the reputation of the Canterbury school under Theodore and Hadrian had waxed great, Ireland attracted Eng-

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[1] Or, perhaps, 'for not a few periods.' This might account for occasional visits to England; see above, p. 292.

[2] Cf. Plummer 2. 197, lines 3-5. See Aldfrith's poem below, and Healy, pp. 468-9. For the schools of Ireland, cf. Healy, *passim*, and Hyde, chaps. 16 and 17.

[3] But see Bright, p. 337.

[4] See Plummer 2. 186; cf. 2. 12, 82, 83, 126, 192, 197.

[5] 2. 260, 263. See also Oman, p. 309: 'first in Ireland, and then at Iona.' For the prediction of an Irish bard that Aldfrith should be buried in Iona, see p. 307, note 12, l. 4.

lish students as Germany for several decades attracted Americans. The classical passage on the subject is the following from Bede, who is speaking of the period from 651 to 664[1]:

> Many, both of the nobility and of the lower ranks of the English people, were there at that time, who, in the days of Bishops Finan and Colman, forsaking their native island, resorted thither, either for the sake of divine studies or of a more continent life; and, while some of them presently devoted themselves to a monastic existence, others chose rather to apply themselves to study, going about from one master's cell to another. The Irish willingly received them all, and took care to supply them gratis with food, books to read, and instruction.

Aldhelm, in his first letter to Aldfrith, speaks of the shiploads of students going and returning, and compares them to bees in search of honey[2]; being not a little piqued, though he had himself received the elements of learning from the Irish Maildaf,[3] because the superiority of the Canterbury school was not sufficiently recognized.[4]

Besides Aldfrith's attainments in Biblical interpretation, and in so much of the liberal arts as was imparted by the Irish scholars, there is one acquisition of the highest importance that he made—he learned to write Irish poetry. Two passages from Adamnan's *Life of Columba,* written soon after Aldfrith had ascended the throne,[5] will serve to illustrate the composition and recitation of poetry among the Irish of the preceding century and more. The first of these refers to a time subsequent to the death of King Oswald in 642, and runs as follows[6]:

> By some poems composed in the Irish language in praise of the same blessed man [Oswald], and by the commemoration of his name, certain wicked men . . . were saved from the hands of their enemies, who in the night had surrounded the house in which they were singing these hymns. They safely escaped through the flames, the swords, and the spears. . . . Nor is it in one place or on one occasion only that the same is known to have happened, but even at different times and places, in both Ireland and Britain.

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[1] *Eccl. Hist.* 3. 27; cf. Plummer 2. 196, 72; Healy, p. 590.

[2] Giles, p. 92.

[3] Giles, p. 339.

[4] Giles, p. 94.

[5] Cf. Reeves, pp. cliv, clv.

[6] Reeves, p. 6 (1. 1).

In the second extract, it is noticeable that singing is accompanied by an instrument, and that definite rules appear to be observed[1]:

> As the saint was sitting one day with the brothers beside the lake Ce (Lough Key, in Roscommon) at the mouth of the river . . . Boyle, a certain Irish poet came to them, and when he retired after a short interview, the brothers said to the saint, 'Why didst thou not ask the poet Cronan, before he went away, to sing us a song with accompaniment, according to the rules of his profession' ['aliquod ex more suæ artis canticum non postulasti modulabiliter decantari']?

With reference to the prosodical system of the ancient Irish, we are told by a recent authority[2]: 'Irish metre presents curious peculiarities. It probably originated in the Latin rhythmic versification, from which, however, it is distinguished by original characters. It is based on a mixture of the use of rhyme, alliteration, stress, number of syllables, and length of words.' Another writes[3]: "The classification and the laws of Irish versification were probably the most complicated that were ever invented. . . . In Irish poetry of all kinds the rhymes were very frequent, occurring not only at the ends of the lines, but also within them—once, twice, or even three times. . . . No poetry of any European language, ancient or modern, could compare with that of Irish for richness of melody.' And still another[4]: 'In order to see beauty in the most ancient Irish verse, it is absolutely necessary to read it in the original, so as to perceive and appreciate the alliteration and other *tours de force* which appear in every line. . . . Here are . . . two verses done into the exact versification of the original, in which interlinear vowel-rhymes, alliterations, and all the other requirements of the Irish are preserved and marked:—

> Mochorb's son of Fiercest FAME,
> KNOWN his NAME for bloody toil,
> To his Gory Grave is GONE,
> He who SHONE o'er SHOUTING Moyle.

[1] Reeves, pp. 30-31 (1. 34); Joyce 1. 445. For Columba's hymn, 'Altus Prosator,' see Plummer 2. 131; Hyde, pp. 180-1; for his Irish poems, Reeves, p. xl; Joyce 2. 503.

[2] Dottin, p. 47.

[3] Joyce 2. 497-8.

[4] Hyde, pp. 273-4.

Kindly King, who Liked not LIES,
  Rash to RISE to Fields of Fame,
Raven-Black his Brows of FEAR,
  Razor-Sharp his SPEAR of flame.

. . . Its beauty depends less upon the intrinsic substance of the thought than the external elegance of the framework.'

Familiarity with the rules of Irish poetic art must have prepared Aldfrith to welcome the extended treatise on Latin prosody, with numerous examples from Virgil and other Latin poets, which Aldhelm sent him in the guise of the second letter referred to above[1]; but it must of course also have been necessary to enable him to compose the Irish poem[2] attributed to him, in which, as Douglas Hyde says, 'he compliments each of the provinces severally, as though he meant to thank the whole nation for their hospitality.'[3] Of this poem there are two principal forms—one of

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[1] Aldhelm (Giles, pp. 327-8) complacently observes that he is the first person of the Germanic race to prosecute these studies so far (quoting Virgil, *G.* 3. 11-13), and urges Aldfrith not to let his royal duties render him neglectful of learning.

[2] Professor Joseph Dunn, of the Catholic University of America, to whom I am indebted for other kind offices, informs me that the poem is composed in a variety of 'Debide' metre, called 'Debide scáilte,' the five laws laid down in Joyce (2. 497) being observed, with the partial exception of (3), the lines ending alternately in a stressed monosyllable and a stressed dissyllable. Cf. Thurneysen, *Irische Texte*, Ser. III, p. 147; Kuno Meyer, *Primer of Irish Metrics*, p. 17.

[3] P. 221. Atkinson remarks in his edition of the Book of Leinster (p. 20), where he prints the poem: 'Here, in fair Inisfail [a poetic name for Ireland], he found life so pleasant that his happiness expressed itself in this poem in the language of his adopted country.' The shorter version, somewhat modernized in spelling, may be found in Hardiman, *Irish Minstrelsy* (London, 1831), pp. 372-5. In *Eriu* 8 (1916). 64-74 (cf. *Rev. Celt.* 38. 94-5), Paul Walsh edits the poem in 96 lines, with a translation. There are three recensions, it appears, of which the second contains only 19 stanzas, and the third, which is nearest to that printed above, 15 stanzas. 'Possibly the first has modified it least, while the others have omitted particular stanzas, and inserted new ones at will.'

In a catalogue of the poems contained in the *Leabhar Breac* (ed. 1878, p. 2), we are also told of 'a series of moral, reflective sentences beginning, "Woe to the man who loves man, and loves not God,"' introduced by the words, 'Fland Fina cecinit.' See also Thurneyson, 'Zu Irischen Handschriften und Litteraturdemkmälern' (*Abh. der Kön. Ges. der Wiss. zu Göttingen, Phil.-Hist. Klasse* 14. 2 (1912). 21-2).

twenty-four stanzas,[1] and another of fifteen. The second of these has been thus translated by Mangan[2] (the last line of the first stanza[3] as corrected by Hyde):

I found in Inisfail the fair,
In Ireland, while in exile there,
Women of worth, both grave and gay men,
Learned clerics, heroic laymen.

I travelled its fruitful provinces round,
And in every one of the five* I found,
Alike in church and in palace hall,
Abundant apparel, and food for all.

Gold and silver I found in money;
Plenty of wheat and plenty of honey;
I found God's people rich in pity,
Found many a feast, and many a city.

I also found in Armagh the splendid,
Meekness, wisdom, and prudence blended,
Fasting, as Christ hath recommended,
And noble councillors untranscended.

I found in each great church moreo'er,
Whether on island or on shore,
Piety, learning, fond affection,
Holy welcome and kind protection.

I found the good lay monks and brothers
Ever beseeching help for others,
And, in their keeping, the Holy Word
Pure as it came from Jesus the Lord.

I found in Munster unfettered of any,
Kings, and queens, and poets a many,
Poets well-skilled in music and measure;
Prosperous doings, mirth and pleasure.

* The two Meaths then formed a distinct province.

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[1] See Edward O'Reilly, 'Irish Writers' (*Transactions of the Iberno-Celtic Society*, 1820, Vol. 1, part 1, p. xlviii); Reeves, p. 284.

[2] Guiney, *James Clarence Mangan*, pp. 118-120; *Poems of James Clarence Mangan*, ed. Mitchel, pp. 379-381; *do.*, ed. D. J. O'Donoghue (London, 1902), pp. 38-41. There is a more literal translation by John O'Donovan (*Dublin Penny Journal*, 1832, pp. 94-5). Cf. *Dublin Review* 21. 519.

[3] The first stanza runs (Hyde, p. 221):

Ro dheat an inis finn Fáil
In Eirinn re imarbháidh,
Iomad ban, ni baoth an breas,
Iomad laoch, iomad cleireach.

I found in Connaught the just, redundance
Of riches, milk in lavish abundance;
Hospitality, vigor, fame,
In Cruachan's* land of heroic name.

I found in the country of Connall† the glorious,
Bravest heroes ever victorious;
Fair-complexioned men and warlike,
Ireland's lights, the high, the starlike!

I found in Ulster from hill to glen,
Hardy warriors, resolute men;
Beauty that bloomed when youth was gone,
And strength transmitted from sire to son.

I found in the noble district of Boyle,
(*MS. here illegible.*)
Brehons, Erenachs,‡ weapons bright,
And horsemen bold and sudden in fight.

I found in Leinster the smooth and sleek,
From Dublin to Slewmargy's § peak,
Flourishing pastures, valor, health,
Long-living worthies, commerce, wealth.

I found, besides, from Ara to Glea,
In the broad rich country of Ossorie,
Sweet fruits, good laws for all and each,
Great chess-players, men of truthful speech.

I found in Meath's fair principality
Virtue, vigor, and hospitality;
Candor, joyfulness, bravery, purity,
Ireland's bulwark and security.

I found strict morals in age and youth,
I found historians recording truth;
The things I sing of in verse unsmooth,
I found them all. I have written sooth.[1]

In the longer version, lines 89-92 are:

Fair Flann Fina, son of Osswy,
The chief sage of knowledge in Ireland,
On the brink of the river Rhine[2] . . .
He got his wish, as was fully granted.

* Cruachan, or Croghan, was the name of the royal palace of Connaught.
† Tyrconnell, the present Donegal.
‡ Brehon, a law judge; Erenach, a ruler, an archdeacon.
§ Slewmargy, a mountain in the Queen's County, near the river Barrow.

[1] Walsh, p. 73.

[2] Professor Dunn tells me that the word translated 'Rhine' might be rendered 'Ren' (unidentified) or 'the sea.' Cf. Reeves, p. 284.

A certain propensity to wander was marked among the Irish from the sixth century to the ninth. Concerning this I quote from Plummer[1]:

> Adamnan tells us how Irish saints set out to look for an uninhabited spot[2] in the ocean. . . . Often they would commit themselves to the deep in a slender coracle, without oarage or steerage, and trust their fate and the direction of their course to the winds and waters.[3] [Thus in 89, according to the *Saxon Chronicle*, three Irishmen came to King Alfred in a boat without any oars from Ireland, whence they had stolen away because they desired for the love of God to be in a state of pilgrimage, they recked not where.] Besides the love of wandering, the desire for self-mortification, and for gaining and imparting knowledge, there was above all the missionary zeal,[4] . . . to which was due the fact that so large a portion of the Continent owed their first knowledge of the glad tidings to Irishmen.

It was perhaps in imitation of such practices that the Northumbrian, Benedict Biscop, made his six journeys to Rome, each time bringing back books, relics, pictures, vestments, and whatever seemed likely to be of use to the monasteries and churches in which he was interested.[5] He returned in 686, or later,[6] from his last visit to Rome, bringing with him, among other things, a volume for which Aldfrith contracted to pay not far from a thousand acres[7] of land. This was a remarkably executed manuscript of the Cosmographers,[8] which he had bought at Rome; when he died, Jan. 12, 690, the transaction had not been completed, and it

[1] 2. 170; cf. 2. 72; Dunn, in *Cath. Hist. Rev.* 6. 442-4.

[2] Cf. Plummer 2. 126, top.

[3] Cf. Joyce 1. 213-4.

[4] The common formula of missionary enterprise among the Irish was: 'Pro Christo peregrinari volens, enavigavit' (Reeves, p. xxxvi); cf. Green, p. 288.

[5] Cf. Plummer 2. 359.

[6] Cf. Plummer 2. 362.

[7] Eight hides; cf. Ramsay, p. 147.

[8] Bede perhaps consulted this very book; at all events, in his *De Temporum Ratione* (A. D. 725), where he is speaking of the rise and setting of the Pleiades, we have this sentence (*Opera*, ed. Giles, 6. 218-9): 'Denique in libris Cosmographorum authenticis et nobilissimis, ita eadem tempora ad lineam distincta reperimus, adnotato etiam ortu Vergiliarum VII Id. Maii, occasu quoque eorundem VII Id. Novemb.' Apparently, then, the cosmographers were not merely geographers, but in some measure astronomers also, though Cassiodorus (ca. 490-585) does not seem to have so regarded them. He, whose writings were among the treasures of the York Library (Alcuin, *De Pont.* 1545), and had perhaps been brought from Rome by

was his successor, Ceolfrith, who eventually received the grant in question.[1] The fact just related would of itself be sufficient to demonstrate Aldfrith's interest in geography and travel[2]; but this is placed beyond all question by his acceptance from Adamnan, probably in 688, of another book of travel, the gift of which was liberally recompensed. This was Bishop Arculf's famous account of the Holy Places, taken down from his lips by Adamnan, which was afterwards made the basis of Bede's book on the same subject, while this, in turn, was abridged to two chapters in the *Ecclesiastical History*.[3]

The story of Arculf's book is sufficiently extraordinary to be called romantic. We find it related, with greater or less fulness, three times—in the introduction to Adamnan's book, in the epilogue to Bede's tract, *On the Holy Places*, and in the *Ecclesiastical History* (5. 15). The first of these accounts is as follows[4]:

> Arculf, a holy bishop, a Gaul by nation, well acquainted with many far distant lands, a truthful and right worthy witness, who dwelt in the city of Jerusalem for a space of nine months, and examined the Holy Places by daily visits, told me, Adamnan, all that is hereafter to be written, as I sedulously asked him to tell me his experiences, which at first I wrote down on tablets as he dictated in a faithful and unimpeachable narrative, and now briefly inscribe upon parchment.

Benedict Biscop, may have stimulated Aldfrith's interest in the subject. Addressing his monks, he says (*De Inst. Div. Litt.*, chap. 25: Migne, *Patr. Lat.* 70. 1139): 'Cosmographiæ quoque notitiam vobis percurrendam esse non immerito suademus, ut loca singula quæ in libris sanctis legitis, in qua parte mundi sint posita evidenter agnoscere debeatis. Quod vobis proveniet absolute, si libellum Julii Oratoris, quem vobis reliqui, studiose legere festinetis; qui maria, insulas, montes famosos, provincias, civitates, flumina, gentes, ita quadrifaria distinctione complexus est, ut pene nihil libro ipsi desit quod ad cosmographiæ notitiam cognoscitur pertinere.' Though you are fixed in one spot, adds Cassiodorus in effect, your minds can roam over the whole earth, wherever man has wandered. The other cosmographers whom he recommends are Marcellinus, Dionysius, and Ptolemy. On the whole subject, see the first volume of Beazley, *The Dawn of Modern Geography*.

[1] Bede, *Hist. Abb.*, chap. 15; Plummer 2. 362, 364.

[2] Dottin, p. 36: 'Of the ancillary sciences, the Irish have cultivated especially genealogy and historical geography.' For a tenth-century geographical poem, see Joyce 1. 440; for the *Cosmography* of Aethicus of Istria, Joyce 1. 403-4.

[3] 5. 16, 17; cf. *Palestine Pilgrims Text Society*, p. xvii; Plummer 2. 304.

[4] *P. P. T. S.*, p. 1.

The second runs thus[1]:

> In this account of the Holy Places, I have, as far as I could, followed trustworthy histories, and especially that of Arculf, a bishop of Gaul, which the presbyter Adamnan, one most learned in the Scriptures, has written in three books in the Latin language. The prelate I have mentioned, leaving his own country, from his desire after the Holy Places, went to the Land of Promise, and there stayed some months in Jerusalem [probably in 670], using an aged monk, Peter by name, equally as guide and interpreter, and visited in his course all the places he had so vividly longed to see, not to speak of Alexandria, Damascus, Constantinople, and Sicily. But when he wished to revisit his native country, the ship in which he sailed was, after many wanderings, brought by a contrary wind to our island of Britain,[2] and at length after many dangers he came to the venerable man of whom we have spoken, Adamnan, to whom he gave an account of his journey and what he saw, and whom he thus taught to become the writer of a most excellent history.

Of the third account I give only the concluding portion[3]:

> And he made a work, as I have said, which is of much use, and specially to those who are so far distant from those places in which the patriarchs and the apostles lived that they can learn as to them only what they can inform themselves about by reading. Now Adamnan brought this book to King Aldfrith, and by his liberality it was read by men of humbler station. The writer also was himself presented by him with many gifts, and sent back to his country.

The circumstances under which Aldfrith received this gift throw a certain light upon his character and upbringing. The year before his accession to the throne was, as we have seen,[4] signalized by an apparently unprovoked[5] assault of his immediate predecessor, Ecgfrith, upon the Irish. This is related, from the Irish point of view, by the biographer of Adamnan, from whose account I extract a few sentences[6]: 'The north Saxons went to Erin and plundered; . . . and they carried off with them a great

[1] *Ibid.*, p. 87.

[2] Cf. *Eccl. Hist.* 5. 15: 'to the western shores of Britain.'

[3] *P. P. T. S.*, p. xiv.

[4] See above, p. 286.

[5] Stevenson and Moberly believe that the invasion was provoked by the harboring of Aldfrith among the Irish (see Plummer 2. 260; Oman, p. 308, note 1).

[6] Reeves, pp. cli, clii.

prey of men and women. The men of Erin besought of Adamnan to go in quest of the captives to Saxonland. . . . Adamnan's demand was that a complete restoration of the captives should be made to him, and that no Saxon should ever again go upon a predatory excursion to Erin; and Adamnan brought back all the captives.' These, as we learn from another source, were sixty in number.[1] Adamnan himself refers to this visit, which took place in 686, two years after Ecgfrith's attack, and to a second, in which he is supposed to have given the book to Aldfrith, in these terms[2]: 'In Saxonia also, when I went to visit my friend King Aldfrith, where the plague was raging and laying waste many of his villages, yet both in its first attack, immediately after the war of Ecgfrith, and in its second, two years subsequently, the Lord mercifully saved me from danger.'[3] 'My *friend* King Aldfrith,' be it observed—though he was the immediate successor of a king who had been a wanton aggressor toward Adamnan's flock, and had carried off a number of them into slavery, besides, according to other accounts, devastating many churches and monasteries.[4]

Thus far we have seen in Aldfrith a student of divinity, half-Irish by birth, and no less so by long residence; a student of the poetic art, himself a poet; and a man sympathetic with the adventurous spirit—eager for learning and wandering, and curious respecting foreign countries[5]—of his Irish kin. To these traits one might add an interest in supernatural visions, disclosed in Bede's account of Dryhthelm, such as is abundantly exemplified in the whole third book of Adamnan's *Life of Columba*.[6]

Aldfrith may then, in imagination, have wandered even further than Ulysses, and at least have spoiled the climes, if not ransacked the ages. It remains to be seen what kind of English king he was. In particular, was he capable of playing a man's part in a troublous time, harassed as he was by foes from without, and afflicted with the internal dissensions of his realm? Of a successor, Ceolwulf,

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[1] Plummer 2. 301.

[2] Reeves, p. 77 (2. 47).

[3] Cf. *Eccl. Hist.* 5. 15, 21.

[4] *Eccl. Hist.* 4. 26; Plummer 2. 260; Bright, p. 330; Montalembert 4. 57.

[5] We must not forget that it was an Irish monk, Dicuil, who in 825 finished a treatise on geography, *De Mensura Orbis Terræ*.

[6] Adamnan himself is credited with having seen a vision, for the text describing which see Dottin, p. 43, note 195.

who, after four intermediate reigns, began to rule twenty-four years later, it has been said[1]: 'Apparently he was a pious king and a lover of scholars; probably he was, as often happens with princes of such a type, too feeble for the times in which his lot was cast.' And Ramsay[2] has said of Aldfrith himself that he was 'perhaps better fitted to rule a convent than a kingdom.' But it was more than the kingdom of Northumbria over which he was called to rule. He was to succeed to the suzerainty over the rest of England which had been held by his line from Edwin,[3] through his uncle Oswald,[4] his father Oswy,[5] and his brother Ecgfrith.[6] Ecgfrith's overthrow and death in battle with the Picts[7] was a terrible disaster, from which Northumbria never entirely recovered.[8] To Aldfrith fell the task of rousing his kingdom from the stupor into which it must have been plunged by so unexampled a defeat, and of providing for its defense against an exultant and fiercely aggressive enemy. That he must have succeeded in this is plain from the words of Bede,[9] that he 'nobly retrieved the state of a kingdom that had been ruined, though it was now less extensive than of yore.' To his personal courage and martial vigor we have, according to Stubbs, the testimony of Henry of Huntingdon that he was 'strenuus in bellis'[10]; and, according to tradition, he died from the effects of a wound received in battle[11] at Scamridge, near Scarborough, though this tradition does not agree[12] with the

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[1] Oman, p. 326.

[2] P. 199.

[3] *Eccl. Hist.* 2. 5; Alcuin, *De Pont.* 120-3; Plummer 2. 86.

[4] *Eccl. Hist.* 2. 5; 3. 6; Plummer 2. 86; Reeves, p. 6 (Bk. 1, chap. 1).

[5] *Eccl. Hist.* 2. 5; 3. 24; 4. 3; Plummer 2. 86, 181; Green, p. 310. For the last three kings, see Freeman 1. 370.

[6] *Eccl. Hist.* 4. 26; Plummer 1. xxxiii; Green, pp. 357-361, but see also pp. 306 ff.

[7] *Eccl. Hist.* 4. 26.

[8] Green, pp. 379, 396; Oman, p. 308; Bright, p. 335.

[9] *Eccl. Hist.* 4. 26; cf. Green, above, p. 287; Montalembert 4. 66. Bright says (p. 338): 'This prince, the first of our literary kings, was a man of practical vigor.'

[10] Ed. Arnold, p. 135.

[11] See below, pp. 324-5.

[12] It is, however, distinctly testified to by a contemporary Irish poet (*Annals of Ireland: Three Fragments*, ed. O'Donovan, p. 111): 'The death of Flann Fiona, son of Ossa, King of Saxonland, the famous wise man, the pupil of Adamnan, of whom Riagail of Bennchair sung:

account given by Eddi.[1] That he was accepted by a proud and resolute people as their accredited representative, and not merely as their nominal leader, is clear from the issue of the great trial of strength between Northumbria and the Roman See.

This trial of strength arose in connection with Wilfrith, one of the most remarkable men of the Old English period. Unconquerable pride, dogged determination, and a restless energy, spent in the overthrow of heathenism and what he understood as heresy, were the outstanding notes of his character. Born in 634, he entered the monastery of Lindisfarne at the age of fourteen, but shortly resolved to visit Rome. This, after various delays, he accomplished at the age of nineteen. He became Bishop of Northumbria at thirty, soon after the Synod of Whitby in 664, where he had triumphed over the Celtic party. This triumph, however, embarrassed and embittered his whole subsequent life. He was not installed in his see till he was thirty-five; nine years afterward his diocese was divided, and his seat was transferred from York to Lindisfarne. To this he objected, and appealed to Rome, but, on his return from that city, was imprisoned, and then exiled. Five or six years later (686?), at the instance of Archbishop Theodore, he was restored by Aldfrith, who had recently become king. Wilfrith, however, seems to have been discontented with his new position, and in 691 or 692, accusations having been brought against him, he was again removed from his

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> This day Bruide fights a battle for the land of his grandfather;
> Unless the Son of God wish it otherwise, he will die in it.
> To-day the son of Oswy was killed in a battle with green swords;
> Although he did penance, he shall lie in Hi after his death;
> This day the son of Oswy was killed, who had the black drinks;
> Christ heard our supplications, they spared Bruide the brave.'

This Bruide, son of Dereli, died the year after Aldfrith (Skene, *Celtic Scotland* 1. 270; *Chronicle of the Picts*, pp. cxxi, 73, 353). This may be taken to imply that Bruide fought a battle with Aldfrith, Aldfrith being slain, and Bruide surviving till the next year.

'Green' [swords] might also be 'gray,' 'blue'; another meaning for the adjective (*glasa*) is 'bitter.' 'Black' [drinks]; alternatively, 'destructive,' 'deadly,' 'poisonous'; *dub* here partly for the sake of alliteration (*duba deoga* = 'black drinks'). L. 86 of Aldfrith's poem (*Eriu* 8. 73) is: 'Brave heroes with blue swords.' (Information from Professor Joseph Dunn.)

[1] Chap. 59. Can it be that Eddi was misinformed, or not disinclined to wrest the truth to the advantage of his cause?

episcopate by the king and several bishops.[1] In 702 a great council was held at Austerfield[2] by Aldfrith, Berhtwald, who had succeeded Theodore as Archbishop of Canterbury, and nearly all the bishops of England, at which Wilfrith was condemned, excommunicated, and stripped of all his possessions except the monastery of Ripon.[3] By 704 he was once more at Rome, prosecuting his appeal. Returning to England in 705, he bore with him the decision of the Pope absolving him from guilt, and proposing measures for a final settlement of the dispute.[4] Wilfrith, on his return, dispatched two messengers to Aldfrith, requesting an interview for the presentation of the documents from Rome. What follows is thus translated from Wilfrith's biographer[5] by Bright[6]:

> Aldfrith gave them a courteous reception, and appointed a day for his definite answer. But when, on that day, they again appeared before him, he, by advice of his counselors, spoke thus: 'Venerable brothers both, ask of me whatever you want for yourselves, and I will give it you. But from this day forth, never ask of me anything for Wilfrith your lord. For what my predecessors, and the archbishop,[7] with their advisers, determined, and what I myself, with the archbishop[8] and nearly all the bishops of the nation, have decided upon, this I am resolved never, while I live, to alter for any alleged writings from the Apostolic see.'[9]

Montalembert,[10] a staunch partisan of Wilfrith, records with

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[1] *Eccl. Hist.* 5. 19.

[2] Haddan and Stubbs 3. 254; Oman, p. 316; Bright, p. 394.

[3] Eddi, chaps. 46, 47; Plummer 2. 319.

[4] Eddi, chaps. 50-54; Montalembert 4. 83-88; Bright, pp. 403 ff.; Oman, p. 316.

[5] Eddi, chap. 58.

[6] Pp. 411-2; cf. Montalembert 4. 92; Oman, p. 316.

[7] Meaning, according to Haddan and Stubbs (3. 266), Ecgfrith and Theodore in 678 and 680.

[8] At the council of Austerfield.

[9] To a similar effect was the exclamation of Berhtwald and Aldfrith at the council of Austerfield, when Wilfrith invoked the authority of Rome (Montalembert 4. 80): "He is guilty by his own acknowledgment. He is worthy to be condemned, if only because he prefers the judgment of Rome to that of his own country." And the king added: "If you desire it, my father, I will compel him to submit by force."' Cf. Eddi, chap. 47; Wm. Malm., *Gest. Pont.*, p. 235; Bright, p. 397.

[10] 4. 29, 37, 69, 76, 98; cf. Eddi, chap. 54; *Eccl. Hist.* 3. 25; Plummer 2. 189.

astonishment and grief the opposition to his hero of such noble and saintly personages as Archbishop Theodore,[1] Abbess Hild, the patroness of Cædmon, Hadrian, Theodore's coadjutor, Benedict Biscop, and Cuthbert. But this is not surprising when we reflect that, with the exception of Theódore and Hadrian, all these noble and saintly personages, with many others of similar stamp, were exponents of the missionary effort of a church whose ways were not the ways of Wilfrith. Green has summed up the effect of this work of evangelization in saying[2]: 'The real life and energy of the new Christianity were concentrated in the north, and the north looked for its religious centre, not to Rome, but to Ireland. . . . The spell which it cast over Northumbria was irresistible.' And Bright has expressed the temper of this Irish Christianity in a single sentence[3]: 'It brought religion straight home to men's hearts by sheer power of love and self-sacrifice: it held up before them, in the unconscious goodness and nobleness of its representatives, the moral evidence for Christianity.' The French biographer of Alcuin, in a striking antithesis, suggests, with some exaggeration, the two principles which were confronting each other in the persons of Wilfrith and his opponents. This is Monnier's epigrammatic summation[4]: 'In Ireland, it was liberty that prevailed; in the Anglo-Saxon territories, it was authority. In the former, religion was enjoyed; in the latter, it was constructed.'

Aldfrith, then, represented a party whose motto was substantially 'Northumbria for the Northumbrians,' which was tantamount to 'England for the English'; and Archbishop Theodore, though wielding a power delegated by Rome, was, on the whole, as we have seen, sympathetic with the national party, in opposition to the harsh insistence of Wilfrith on Roman supremacy. In this contest, Benedict Biscop and Aldfrith, as Bishop Stubbs has said,[5] were 'thoroughly at one with the comprehensive church-

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[1] Cf. Oman, p. 317: 'His [Wilfrith's] haughty bearing and unconciliatory disposition were the real cause of his long strife with men of such excellent character as Archbishop Theodore and King Aldfrith.'

[2] P. 312; cf. p. 276.

[3] P. 204.

[4] Monnier, *Alcuin et Charlemagne*, p. 40.

[5] *Dict. Chr. Biog.* 1. 77. It must not be overlooked that of Archbishop Berhtwald (d. 731) the *Saxon Chronicle* says (692): 'Hitherto our bishops

policy of Archbishop Theodore.' It is no wonder, then, if Aldfrith was beloved by his Northumbrian subjects. Montalembert, who, it will be remembered, sympathizes with his opponent, declares[1] that he 'ranks among the most enlightened and justly popular princes of his time,' and elsewhere calls him[2] 'a monarch justly dear to the Northumbrians.'

A man of spirit this king was, we see, notwithstanding the 'learning, meekness, and piety' which Oman[3] attributes to him. A man of poetry and visions, notwithstanding—shall we not rather say because of?—his intense devotion to the sacred Scriptures. A man of attachments and affections—to his foster country, to his friends, Benedict Biscop and Adamnan, to his councillors, and to his realm—carrying them with him in his private interests and his public duties. Withal, a man who, according to Montalembert,[4]

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had been Roman; henceforth they were English.' Aldhelm, who was consecrated bishop by Berhtwald in 705, had been his fellow-student under Theodore at Canterbury (Wm. Malm., *Gest. Pont.*, p. 376), so it is at least possible (see above, p. 294) that Aldfrith and Berhtwald had also been fellow-students, and therefore friends from youth. Berhtwald, like Aldfrith, was of royal race, being the nephew of King Æthelred of Mercia (Eddi, chap. 40; Wm. Malm., *Gest. Reg.*, Bk. 1, § 29), and was therefore reputed to be 13th in descent from Woden, as Aldfrith was 17th, and Aldhelm 15th (see the genealogical tables appended to Lappenberg, Vol. 1). They thus represented three royal houses descended from a common mythical ancestor—of Mercia, Northumbria (Bernicia), and Wessex. It is curious, if not particularly significant, that there had been an Aldhelm who was cousin to Æthelfrith (see above, p. 285), and grandson of Ida, the founder in England of the Bernician royal line (*Eccl. Hist.* 5. 24; Plummer 2. 119, 120; Chadwick, *Origin of the English Nation*, p. 156), while Æthelfrith, in his turn, was the grandfather of Aldfrith. Of the perpetuation of protothemes and deuterothemes (cf. Searle, *Onomasticon Anglo-Saxonicum*, pp. xii ff.) in the same family, see Weinhold, *Altnordisches Leben*, pp. 267 ff.

Light is thrown upon Berhtwald's character by a letter written between 709 and 712, in which he begs Forthhere, Aldhelm's successor as Bishop of Sherborne, to intercede with Beornwald, Abbot of Glastonbury, for the release, on payment down by her brother, the bearer of the letter, of three hundred shillings, of a Kentish captive girl, 'so that she may pass the remainder of her life with her kinsfolk, not in the sorrowfulness of slavery, but in the gladness of freedom.' A first application having been of no avail, he now renews it. See *Monumenta Moguntina*, ed. Jaffé, p. 48.

[1] 4. 81.

[2] 4. 72.

[3] P. 315.

[4] 4. 67.

was indebted to his residence in Celtic lands for 'that passionate curiosity and lavish liberality which may be traced among the Irish of the seventh century, and which seems a kind of prelude to the revival of learning in the fifteenth century.'

In the paucity of our information concerning Aldfrith, few, if any, traits can be added to this characterization of him. It has, however, been suggested,[1] on the basis of the rather numerous Greek words in Aldhelm's first letter to him, that he may have been somewhat acquainted with that language. On this supposition, we are not bound to assume that he learned his Greek in Ireland, since he might have studied it under Theodore and Hadrian; or, if under Irish teachers, it might have been such as had undergone an influence from the Canterbury school.[2] However, on this point nothing definite has been, or perhaps can be, determined.

It may also be plausibly argued, on the strength of a passage in Bede's *History of the Abbots* (chap. 9), taken in conjunction with the munificence of his rewards for books, that he was addicted to display. What Bede tells us is that, on Benedict Biscop's return from his sixth visit to Rome, he brought with him, among other things, two silken cloaks of incomparable workmanship, which, when he found that King Ecgfrith, his patron, was dead, he disposed of to Aldfrith, receiving from him and his councillors an estate of three hides—say, three hundred and fifty acres—of land at Wearmouth. Now, since this grant was made with the sanction of the *witenagemōt*, the purchase can hardly have been for Aldfrith's personal behoof,[3] and we may accordingly conceive of these silken cloaks—possibly of Oriental manufacture—as intended for gifts to allied princes, or perhaps to signalize the loyalty and public spirit of some nobleman or public official—much as Hrothgar, after the slaying of Grendel, bestowed upon Beowulf a golden ensign, a helmet, a coat of mail, and a jeweled sword. Perhaps, therefore, this episode may serve to illustrate the lavish liberality of which Montalembert speaks, just as the acquisition of books dealing with remote parts of the world may exemplify his passionate curiosity.

What effect on the production of national literature is the

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[1] Manitius, p. 541.

[2] Roger, *L'Enseignement des Lettres Classiques d'Ausone à Alcuin*, p. 271.

[3] See Bright, p. 338.

twenty years' reign of such a king likely to have had, the country ruled being that Northumbria which was still the foremost among English realms, ripened and tempered by a hegemony of more than half a century, by conflict with heathen tribes, and by the mild and lovable Christianity inculcated by the Irish missionaries? What sort of literature would result from such an influence as that which King Aldfrith may be presumed to have exerted upon his English subjects? As the Scandinavian Vikings were Germanic, like the Anglo-Saxons, an answer to these questions may be suggested by an extract from a recent and authoritative history of the Norsemen[1]:

> That the religious and literary life so highly developed among the Irish, their love of nature, their lyric sentimentality and sympathetic and emotional character, made a deep impression on the stern Norsemen is certain. They, who came to conquer, were in turn conquered by this new and gentle influence. Long before they were converted to Christianity, their lives and views were deeply affected by ideas acquired in the Christian countries which they visited, and especially through their sojourn in Ireland. It was largely due to this new stimulus that Norse scaldic poetry and the saga literature began to flourish in the Viking period, and that Norse mythology assumes at this time a distinctly new form, in which we find embedded in the strata of pagan thought many unmistakable fragments of Christian ideas, as the conceptions of creation, of righteousness, of good and evil, as well as views of the life hereafter, which can have their origin only in the realm of Christian faith and morality.

IV. THE COMPOSITION OF *BEOWULF*

The problem of the final recension of *Beowulf,* its place and time, has much exercised the wits of those who have addressed themselves to it, but no one seems yet to have reached a definitive solution. As to the place, the choice has practically lain between Northumbria and Mercia, those who have favored Mercia having been moved primarily, though not exclusively, by a single consideration. The arguments for and against each of these kingdoms have been conveniently set forth by a scholar distinguished both by technical equipment and literary culture, and may, as a basis for discussion, be summarized here.

Ten Brink, in discussing the place of composition of the

[1] Gjerset, *History of the Norwegian People* I. 94-5.

Beowulf, lays down these conditions,[1] as postulated by the nature of what he considers to be the nucleus of the poem:

(1) The enhancement of national consciousness in the body of the people, or of a sense of solidarity on the part of the *comitatus* —the *hird*, as the Norsemen came to call it.

(2) A refinement and gentleness of manners, suggesting a relatively advanced stage of civilization, and therefore a certain stability of the body corporate.

(3) The Christianity[2] following upon the heathenism in which the mythical elements originated must have been of a tolerant and relatively undogmatic character, and in harmony with the national temper. All these conditions he finds fulfilled in the Northumbria of the first half of the seventh century. The Durham *Liber Vitæ* contains a surprisingly large number of the names which occur in *Beowulf*,[3] and the nuclear legend might well have come to England with the expeditions which resulted in the founding of the Bernician kingdom by Ida in 547. He points[4] out in detail how the above formulated conditions were fulfilled in the period preceding 642 or 650, but hardly continuing much later than this. Hereupon he goes off in an endeavor to show that the further evolution of the poem belongs to Mercia, though, in contrast with his statement about Northumbria, he in one place expresses himself thus[5]: 'In Mercia there were fewer clergy, and fewer institu-

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[1] *Beowulf*, p. 223.

[2] Incidentally he says: 'Der Kern von A durchaus christlich . . . ist.' See Brandl, p. 62, and compare the valuable study by Klaeber, 'Die Christlichen Elemente im Beowulf,' in *Anglia*, Vols. 35 and 36 (1911-2), and, for essential agreement, Chambers, *Beowulf*, 1921, pp. 126-8; Gerould, *Saints' Legends*, p. 60; Emerson, in *Mod. Lang. Rev.* 16. 113-9.

[3] Cf. Brandl, p. 59. Chadwick says, pp. 43-4: 'The total number of personal names found in the five poems, Beowulf, Finn, Waldhere, Widsith, and Deor, is 132. . . . Over forty of these names belonged to persons who appear to have lived, or at any rate to have been born, before the end of the seventh century, while at least thirteen of them are unknown after the same period. To the latter class belong the important names, Widsith and Beowulf. . . . If we add the place-names to the personal names, the total number of heroic names found in England in historical documents seems to be 76. Out of this number only seven, apparently, are limited to persons born after the end of the seventh century.'

[4] *Beowulf*, p. 224 ff.

[5] Pp. 228-9.

tions of spiritual culture, than in the other English kingdoms; here there flourished no Christian scholarship, and, so far as we are informed, no Christian poetry. But all the better on this account could ancient tradition and the ancient popular poetry be kept alive.'

It must, one would think, be clear, however, that the three conditions which Ten Brink lays down as indispensable for creating the nucleus of the *Beowulf* are much better satisfied by the latter half of the seventh century, after the conversion of Northumbria was in full swing, and especially by the age of Aldfrith,[1] than by the former half. Ten Brink himself regards the Irish influence as highly important,[2] though he goes so far as to assume that Oswald's reign of eight years was sufficient to compass the results which he thus describes: 'Wenn die englische Poesie, soviel wir wissen, in Nordhumbrien eine kräftigere Blüte entfaltete als anderswo, so hängt dies mit jener von den schottischen Glaubensboten geübten Schonung der nationalen Eigenart . . . zusammen.'

Ten Brink's chief reason for favoring Mercia as the region where the *Beowulf* assumed its final form is connected with the episode relating to Offa (1931-62). The first lines of this passage deal with a queen, Thryth or Thrytho, who is contrasted by the poet, for her evil qualities, with Hygd, wife of Hygelac, a wise and well nurtured queen. Eventually Thryth marries Offa, whom the poet highly praises, and becomes celebrated for her goodness. On the passage in question, thirty-one and a half lines in length, reposes the principal argument in favor of Mercia. The Offa presented by the poem was a Continental Anglian king of the fourth century, of whom nothing contemporary is known. All the information we have concerning him is contained (1) in the genealogy of the royal line of Mercia, as given in the *Saxon Chronicle* (626) and by Florence of Worcester; (2) in the Danish history of Saxo Grammaticus; and (3) in the Latin *Lives of the Two Offas*—both the latter works having been written about 1200 A. D. This is the Offa of *Beowulf* and of *Widsith* (35-44).

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[1] Ten Brink (p. 227) thinks of Aldfrith merely as the patron of the scholarship represented by Bede, while Green (p. 398) talks of the 'school of biography' represented by Eddi and the author of the anonymous life of Cuthbert.

[2] P. 226; cf. Lappenberg 1. 200-201.

Of him Chadwick says (*Origin of the English Nation*, p. 131): 'We may infer with some probability that Offa was the most famous of the kings of Angel.'

The most famous Offa that ever existed in England was the one who ruled over Mercia from 757 to 796. With him Charlemagne dealt almost as an equal, and he seems to have been regarded on the Continent as monarch of the whole English nation.[1] It was he who founded the monastery of St. Albans. He, it is evident, can not be, for reasons of chronology, the Offa of *Widsith* and *Beowulf*. However, there was produced in the monastery of St. Albans, about the year 1200, as we have seen, the *Lives of the Two Offas*—that is, of the Continental and the Mercian. The life of the Mercian Offa has much to say concerning the murderous disposition of his wife Drida—which is evidently only another form of Thryth or Thrytho. This can not be accounted for by any known historical fact. Offa's wife was named Cynethryth, the second element in which name may account for the Drida, or Thryth; but Cynethryth, being known for her piety, was of a totally different nature.[2]

As an inference from the thirteenth-century *Lives of the Two Offas*, and from the fact that the Continental Offa appears in the Mercian genealogy, Ten Brink was led to conclude[3] that those who were most interested in the Beowulfian reference to Offa would naturally have been Mercian, especially as the passage in question is quite episodic, and its introduction seems decidedly forced. He next asked whether, after all, there might not have been a historic character from whom the traits ascribed to Thryth might have been derived. Such a historic original he found in Osthryth, wife of King Æthelred of Mercia, who reigned from 675 to 704, and finally retired to the monastery of Bardney, where he died in 716. Of Osthryth we know but little: Eddi[4] tells us that her husband and she, under the influence of Ecgfrith of Northumbria, her brother, refused in 681 to allow Wilfrith, who had taken refuge in Mercia, to stay there another day after they were apprised of his presence; and the next incident we learn concerning her is

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[1] Oman, pp. 340-1.

[2] Chadwick, *Origin*, p. 121.

[3] Pp. 116, 221-2; cf. Brandl, p. 61.

[4] Chap. 40.

this from Bede,[1] under the year 697: 'Queen Osthryth was slain by her own nobles, those, namely, of the Mercians.' From this Ten Brink draws the not unreasonable inference that the queen had incurred the hatred of her people, or at all events of her nobility, by her harshness and cruelty. What was known of her character might thus have led a contemporary poet to give actuality to his work by introducing her into it, under the name of Thryth, as a feminine counterpart of the ferocious Heremod (*Beow.* 1709 ff.). Ten Brink then concludes that this episode must have been introduced between 697 and 700.[2]

V. ALDFRITH AND *BEOWULF*

If we admit, with Ten Brink, the appropriation of a single current event or character by the poet of *Beowulf*, it is surely permissible to look about us, if perchance we may discover in it, under transparent disguises, other facts of contemporary biography or history. The one we have noted occurred in 697, and Brandl[3] assigns to *Beowulf* the approximate date of 700. We are still within the reign of Aldfrith, and perhaps at his court, for it is at a king's court that we may most easily conceive the poet of *Beowulf* as living. This has been clearly seen by Brandl,[4] who argues that it is thus easiest to explain the poet's unusual knowledge of history, his familiarity with the courtly manners displayed at the reception of Beowulf by Hrothgar, and on other occasions,[5] and his repeated inculcation of the duties of a good king. Now, if Oman is right[6] in apprehending that the murder of Osthryth 'would seem to point to civil strife and palace revolutions,' it is evident that during the remaining seven years of Æthelred's reign, it is not at the Mercian court that such lessons could well be learned; nor were conditions much, if any, more favorable during the two succeeding reigns (704-716).[7]

[1] *Eccl. Hist.* 5. 24; cf. *Sax. Chr.* 697.

[2] Pp. 116, 230-1.

[3] Pp. 51, 61; so Chambers, *Beowulf*, 1921, p. 332. Already in 1849, Jakob Grimm thus dated the *Beowulf* (*Abh. der Berliner Akad.*, p. 230): 'dessen jetzige gestalt höchstens dem siebenten oder gar achten jahrh. angehört.'

[4] P. 61.

[5] Cf. *Beow.* 358-9, 613 ff., 921 ff.

[6] P. 314.

[7] See Oman, p. 315.

As for Aldfrith, we have seen how studious he was, how literary, how virtuous, and, on at least one occasion, how urbane—when, though in the sequel he showed himself unyielding in a matter of the greatest concern, he met with courtesy the envoys dispatched to him by Wilfrith.[1] Accordingly, we must first of all seek what there was in his character and circumstances which could be converted by the poet to his uses; and, since we have been considering the episode of Offa and Thryth, it is natural at the outset to dwell upon hitherto neglected features of that. Osthryth was Ecgfrith's sister,[2] and therefore Aldfrith's half-sister. She was so much under Ecgfrith's influence that she displayed indecent haste in ridding her realm of Wilfrith's presence; and her unloveliness—to call it by no harsher name—may well have been the cause of her violent death. Ecgfrith himself had been capable of the wanton attack upon the Irish—some of whom were Aldfrith's kinsfolk—a year before Aldfrith succeeded him on the throne; and he had willingly allowed the latter to remain for many years an exile, if indeed he was not directly responsible for his banishment. We may fairly assume, then, an estrangement, not only between Aldfrith and his half-brother the king, but also between Aldfrith and his half-sister, the Mercian queen. The royal family having been introduced into the poem by the bard of the court, and displayed in an unfavorable light, what remained except to introduce Aldfrith himself in an agreeable aspect, and that in the same context? This, then, we may conceive of the poet as doing in lines $1955\text{-}60^a$, by making Aldfrith, under the name of Offa, the husband, instead of the brother, of the queen, and crediting his goodness with the power to redeem even her froward nature—while at the same time throwing the whole episode back more than three hundred years, and identifying Aldfrith with the semi-mythical Offa, the most famous of the Anglian kings of the Continent. The passage[3] illustrating this introduces Thryth after she has become queen in Offa's hall ($1951^b\text{-}60^a$): 'There, while she lived, she enjoyed her destiny upon the throne, famed for her goodness. She held high love toward the prince of heroes, who, as I have heard, was the best of all mankind

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[1] Above, p. 308.

[2] *Eccl. Hist.* 4. 21.

[3] Tinker's translation.

between the seas,[1] best of all the race of men upon the earth. Therefore Offa, bold with the spear,[2] was honored far and wide for his gifts and his warfare. Wisely he ruled his native land.'

But with what propriety, it may be asked, could a member of the royal family of Northumbria be designated as Offa, seeing that the ancient Offa was appropriated as an ancestor by the Mercian dynasty? Because, for one thing, the lines between the two branches of the Anglian house were not so sharply drawn as has sometimes been assumed. An uncle of Aldfrith's, banished with all his brothers, had been named Offa; and a son of Aldfrith's, who came to a sad end, bore the same name.[3] It may therefore

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[1] Here perhaps with allusion to the Northumbrian realm, between the North and the Irish Sea. Elsewhere it is applied in *Beowulf* to Hrothgar's kingdom, perhaps also conceived as Northumbria, or, by extension, England: 858(?), 1297, 1685. The authors of *Guthlac* and *Exodus* imitate *Beowulf*. Of the two occurrences in *Guthlac*, one specifically designates England (1333): 'the best between the two seas that we in England have ever heard of.' The other (237) seems generalized to include the world, as perhaps also in *Beow.* 858. In Ps. 72. 8 (cf. Zech. 9. 10), we doubtless have the ultimate original (cf. the Old English poetical version), there, too, the original limitation—in this case to the Red Sea and the Mediterranean—being extended by the poet's idealizing vision, while it is still limited in *Exod.* 442, 562. Psalm 72 being associated in the superscription with Solomon, an allusion to Aldfrith would be particularly happy; see above, p. 293. In a wide sense, the author of *Beowulf* might be conceived as preluding Shakespeare's (*Rich.* II. 2. 1)

> This precious stone set in the silver sea,
> Which serves it in the office of a wall,
> Or as a moat defensive to a house,

and Tennyson's (*To the Queen*)

> And compassed by the inviolate sea.

[2] Compare Henry of Huntingdon's 'strenuus in bellis' (above, p. 306).

[3] For both these see *Dict. Chr. Biog.* 4. 67. Here the name supposed to be peculiarly Mercian is found in two successive generations in the Northumbrian line; but conversely, as Aldfrith had a brother, Ecgfrith, and a sister, Ælffled, so, about a century later, two children of the Mercian Offa (see above, p. 315) bore these names—Ecgfrith (-ferth) reigning 785 (?)-796, and Ælffled being from 792 to 796 wife of King Æthelred of Northumbria (cf. Oman, pp. 348-9).

The fate of Offa, Aldfrith's son, was bound up with the fortunes of Cynewulf, Bishop of Lindisfarne, whom various scholars of repute—Carleton Brown being the latest—have identified with the poet of that name. See *Dict. Nat. Biog.* 16. 304; my edition of the *Christ*, p. lxxii; and my edition of the *Elene, Phœnix, and Physiologus*, p. xiii, note 3.

have been Aldfrith's known attachment to one or both of these relatives which was also in the poet's mind.

In dealing with the episodic passage concerning Thryth, we have assumed the possibility that Aldfrith was there figured under the historic or legendary name of Offa, described as the best of all mankind between the seas, and as wisely ruling his native land. The characterization is a summary one, and leaves out of account certain traits which we are reasonably safe in attributing to Aldfrith. Such traits are at least among those which belong to Hrothgar. In the first place, since he was old, we find the king of the Danes not unnaturally described as wise (1313, 1318, 1384, 1400, 1475, 1698, 1786, 2156), reminiscent (371-381, 459-472) and somewhat acquainted with racial tradition (1709-22), and on occasion didactic (1722-68). As befitted a king of Germanic race, he was brave (1041 ff., 1771 ff.), magnanimous (2110), and openhanded (71 ff., 80, 1028 ff., 1868 ff., 1884-7, 2101-2). Coming to more personal characteristics, he is a man of sensibility, affectionate and emotional (1322 ff., 1397-8, 1870-80), courteous (391-4, 456-9, 652 ff., 946 ff., 1698 ff., 1840 ff.), and, withal, musical and poetic (2105-14). More than one of these points are illustrated by the lines last cited, Beowulf's account to his lord, Hygelac, of Hrothgar's contribution to the entertainment in hall after the victory over Grendel (cf. 1008 ff.). This is the account:

> There was song and glee. The aged Scylding, when he had asked of many things, told of the days of yore. At times the brave warrior touched the joyous harp, the instrument of mirth; at times he chanted a lay, truthful and sad; at times the great-hearted king would relate aright some strange legend; at times the hoary warrior, stricken with age, would lament his youth and battle-strength; his heart surged within him as, old in years, he brought to mind so many things.[1]

[1] For the attribution of all these activities to Hrothgar, see Chambers' note on 2107, and Grein's translation. For another rendering of the passage, see Chadwick, pp. 83-4, who confronts it with a highly interesting extract from a description by the Greek historian, Priscus, of an episode in his visit to Attila of the year 448 (p. 84): 'When evening came on, torches were lighted, and two barbarians stepped forth in front of Attila, and recited poems which they had composed, recounting [chanting] his victories and his valiant deeds in war. The banqueters fixed their eyes upon them, some being charmed with the poems, while others were roused in spirit, as the recollection of their wars came back to them. Others again burst into tears, because their bodies were enfeebled by age, and their martial ardor

Twice, at moments of jubilation over Beowulf's prowess, it is said of Hrothgar, with the unanimous consent of his own people and of Beowulf's retainers, 'He was a good king!' 'He was *one* king!'

Now, how was it in these respects with Aldfrith? At the beginning of the eighth century he might be called old, or at least elderly. We have learned of his wisdom, his martial vigor, his liberality in reward, his urbanity, his composition of a series of moral, reflective sentiments, his skill in versification, and his interest in the world which lay outside of Britain. His sensibility may be argued from his interest in poetry,[1] and the love for the Irish people displayed in his verse, and manifested in deeds at the instance of Adamnan; but it may also be in some measure inferred from the heartiness with which he made common cause with his people in their resistance to what he and they regarded as the encroachments of Roman power, and not less by his lingering regrets at leaving English soil, even for study in Ireland, if Bede is faithful to the monarch's sentiments in rendering them[2] by a line adapted from the first *Eclogue* of Virgil:

> I from my fatherland,
> My fatherland and pastures ever dear,
> To exile fly.

Hrothgar's warnings (1724-68) to Beowulf, in the lengthy discourse addressed to the hero after the slaying of Grendel's dam, have often been stigmatized as dull, and as delivered in a stereotyped homiletical fashion.[3] They gain in interest, however, if we believe them to have grown out of the historic experiences of Aldfrith. In that case, the person at whom the king's censure is leveled can

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had perforce to remain unsatisfied' [calm, at rest]. For the bursting into tears, see *Od.* 8. 83 ff., 521 ff.; for the recounting of valiant deeds in song, *Il.* 9. 189, 520; *Od.* 8. 73.

[1] Aldfrith's poem, it must be admitted, is inferior in its feeling for nature, and its lyrical beauty in general, to the two attributed to Columba and Deirdré, as printed by Joyce (2. 503-5).

[2] Bede, *Vita Metr. Cudb.* 21. 47-8:

> Nam patriæ fines et dulcia liqueret arva,
> Sedulus ut Domini mysteria disceret exul.

[3] Cf., for example, Brandl, p. 62. A knowledge of the Bible, which might well be Aldfrithian, is betrayed in 1743 ff. (Eph. 6. 16; see *Chr.* 763 ff., 779 ff., and my notes).

hardly be any one else than Wilfrith. We must not forget that Aldfrith believed he had just grounds for disapproving of that prelate, and that his disapprobation and resentment were publicly and officially manifested on more than one occasion. Seven or eight years before Aldfrith's accession to the throne, bitter accusations were launched against Wilfrith, of a tenor which, if they could be substantiated, would go far to justify Hrothgar's charges of insolence, baleful rancor, and arrogance[1] (1740, 1758, 1760). These accusations are put by the historians into the mouth of Eormenburh, Ecgfrith's wife, though William of Malmesbury believes that she was not alone in her denunciations. In the words of Montalembert,[2] she represented to the king

> the shameless pomp and luxury displayed on every occasion by the Bishop of York—his immense riches, his services of gold and silver, the increasing number of his monasteries, the vast grandeur of his buildings, his innumerable army of dependents and vassals, better armed and better clothed, perhaps, than those of the king. . . . The moment might be foreseen when all those estates, given by the generosity of the Northumbrians to the sanctuaries of the new religion, would become the appanage of one man.

Another of Wilfrith's biographers[3] makes her say: 'Your whole kingdom is his bishopric. What if in time of war he should keep back his men from fighting on your side?' At one time Aldhelm felt that he had to write a letter to certain of Wilfrith's clergy,[4] to keep them true to their allegiance. Bede, we are told,[5] had the warmest admiration for the kings who expelled Wilfrith. Oman[6] calls him 'a great lover of state and dignity, a very stiff-backed adversary, who always stood upon his rights. . . . He has been compared in character, and not inaptly, to Becket.' And Raine says[7]: 'Throughout his life he was far too careless of the opinions and feelings of others.'

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[1] Contrast the Ulysses of *Od.* 4. 689-693.

[2] 4. 25. Cf. Eddi, chaps. 24, 21; Wm. Malm., *Gest. Pont.*, p. 219; Bright, p. 281.

[3] Eadmer, chap. 26 (*Histor. Church York* 1. 187).

[4] Giles, pp. 334-5; Montalembert 4. 225-6.

[5] Plummer 2. 316.

[6] P. 304.

[7] *Histor. Church York* 1. xxviii. The evil trait against which Hrothgar's warning is directed is thus described by Aldhelm (*De Virg.* 2712-6):

If Grendel is not a mere bogle or troll of popular superstition, he may possibly symbolize the devastation wrought by the Picts and Scots,[1] bearing God's anger (711), and descending over the dark moors (710, 1405) to slay and despoil, a haunting terror to the Northumbrian realm since the day of that dreadful battle[2] in eastern Scotland in which, from the full height of his power, Ecgfrith untimely fell. For aught we know, it may have been at the hands of the same enemies that Aldfrith himself was mortally wounded, in that

> place of tombs,
> Where lay the mighty bones of ancient men.[3]

But if there is any ground for assuming that the character of Aldfrith is reflected in Offa or Hrothgar, what shall we say of any similar resemblance to the aged Beowulf? Like Hrothgar, he ruled his kingdom fifty years[4] (1769, 2209, 2733)—evidently a poetical round number—but otherwise there is not much that can be cited as in common. The dread of the Picts and Scots[5] may, perchance, it is true, lie behind the utterance of the messenger who carries to his comrades the news of Beowulf's death, especially if in the difficult line, 3005, we could feel justified in referring *hæleða hryre* to the slaughter of Ecgfrith's whole army at Nechtansmere. Thus the passage runs (2999-3007; cf. 3021-30):

> Primo contemptus procerum præcepta docentum,
> Dum mentis typhus ventoso pectore turget;
> Necnon invidiæ pestis progignitur inde,
> Quæ solet æquales tumido contemnere fastu,
> Atque satellitibus spretis regnare superba.

Cf. Virgil, *Aen.* 11. 15 (with 10. 852); 11. 539. For the imagery of darts and arrows, cf. Aldhelm, ed. Ehwald, 201. 25-6 (Giles 327. 4-6); 245. 6-8 (Giles 16. 11-13); and p. 320, note 3.

[1] The idea of aid against such a foe—Beowulf against Grendel—might have been confirmed in Aldfrith's mind by the fact, which he may have first known as a lad, of the enlistment in Oswin's *hird* of English nobles from other provinces (*Eccl. Hist.* 3. 14).

[2] Cf. p. 306, note 8.

[3] Cf. p. 324.

[4] As in the fifty ships of Achilles, each ship seating fifty men (*Il.* 16. 168-170), or in the twenty years of Ulysses' wanderings (*Il.* 24. 765; *Od.* 2. 175, etc.), or the ten years' war with Troy (*Od.* 5. 107; 14. 241).

[5] May there be a covert reference to Aldfrith's defense of his Northumbrian kingdom against these enemies in 1770^{b}-72^{a}?

> Such is the feud and the enmity, the deadly strife of nations, for which, as I ween, the Swedish people will attack us, soon as they learn that our lord is dead, he who upheld our treasure and our realm against the foe after *the overthrow of heroes,* wrought good for his people, and furthermore did great and glorious deeds.

Finally, it may not be altogether unreasonable to regard Beowulf's Homeric cairn upon the headland of Hronesness as representing, in one aspect, the poetic enhancement and exaltation of that monument at Driffield which kept Aldfrith's memory alive for so many centuries.

VI. THE EAST RIDING AND *BEOWULF*

The circumstances of Aldfrith's death, and the fact that his memory was perpetuated for a thousand years in the place where he died, deserve consideration in some detail, for their bearing upon his possible relation to the composition of *Beowulf*.

The *Saxon Chronicle* records the death of Aldfrith as occurring at Driffield, on Dec. 14, 705. An Irish contemporary, as we have seen,[1] declared that he was slain in battle. There are now two places of the name of Driffield, both some 27 miles E. of York, 20 miles S. of Scarborough, and 11 miles N. of Beverley. Great Driffield has a population of about 6000; Little Driffield, a mile to the N. W., has only two or three hundred inhabitants. Of Little Driffield, Black's *Picturesque Guide to Yorkshire* (1871) reports (p. 119): 'A marble tablet in the Chapel, which is a respectable building, bears the inscription:—"Here lies the body of Alfred, King of Northumberland, who departed this life January 19th, A. D. 705, in the xxth year of his reign. . . ."' Here 'Northumberland, for 'Northumbria,' is misleading, 'Alfred' is a not unexampled corruption of 'Aldfrith,' and 'January 19th' is positively wrong, being a misreading of 'the 19th of the Calends of January.' But the tablet is modern and negligible. The *Guide* continues: 'There can be no doubt that Driffield was the scene of many fierce battles about the time referred to, for the tumuli of the slain may yet be seen in various places in the neighborhood; it is not improbable, therefore, that Alfred may have received his death-wound here, if he fell in battle, as some writers say.

[1] Above, p. 307.

Search has been more than once made for the bones of the king, but in vain. The vicinity of Driffield has, however, yielded many valuable facts respecting British burials. In the tumuli have been found flint spear heads, fragments of urns, beads of jet, amber, and glass, and other ornaments, along with the crumbling skeletons of their possessors. The skeletons of females have been found in the tumuli on these Wolds, with the bracelets, rings, brooches, and beads that adorned them in life; and British charioteers have been found with their accoutrements, and even the remains of the skeletons of their steeds lying beside them.'[1]

In Murray's *Handbook for Travellers in Yorkshire* (1874; earlier edition, 1866-8), compiled by the accomplished antiquary, Richard John King (1818-1879), we have the following (p. 156): 'Driffield, . . . the "field," or open space, in the midst of the great woods of Deira.[2] . . . Many tumuli and sepulchral mounds, of various dates, exist in the neighborhood, one of which, a high tumulus, . . . was opened in 1851, and proved to be British. . . . Early Saxon grave-mounds have also been opened here, and have disclosed amber beads and rock-crystal pebbles. . . . Some large barrows on the road N. of Driffield are known as "Danes' graves."' Of the church at Little Driffield this work observes: 'Here is the supposed tomb of Alfred, King of Northumbria (died circa 727). The tradition that he died and was buried here is as old as the time of Leland, who says that a Latin inscription was to be seen on the tomb. This, and the tomb itself, have disappeared.' Later we are told by the same writer (p. 177) concerning Ebberston, some eighteen miles distant: 'Above the village is, or was, a small cave in a rock, called Ilfrid's or Alfrid's Hole. Tradition (and one of long standing, since there was formerly an inscription over the cave recording it) asserts that Alfred of Northumbria was wounded in a battle within the entrenchments of Scamridge (long lines on the moors above Ebberston, which are, however, in all probability, British works), that he fled, took shelter in this cave, and was on the following day taken to Driffield, where he died.' Bishop Stubbs, in his sketch of Aldfrith in the *Dictionary of Christian Biography*, summarizes King's state-

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[1] Cf. Greenwell, *British Barrows*, p. 484; Raine, *Histor. Church York* I. ix, x.

[2] See White, p. 42.

ment, without expressing his own opinion. In any case, the tomb, with its Latin inscription, was well known in the time of Leland, who died in the year of the poet Spenser's birth. Leland remarks in his *Collectanea* (ed. Hearne, 1720, 4. 34) of Little Driffield: 'Habet enim ecclesiolam, sed celebrem monumento cujusdam Saxoni regis cum inscriptione Latina. Adjacet et Drifeldæ ager cognomento Danicus, multis interfectorum tumulis spectabilis. Famaque vulgaris est, belli alea regem in illo occubuisse agro, sæviente per illa tempora tyrannide Danica.' Elsewhere he says (3. 296): 'Alfredus, rex Northimbrorum, periit Drifeldæ, cujus ibi sepulchrum etiam nunc extat.' The tomb was still shown in the time of Smith, the editor of Bede's *Ecclesiastical History*, who died in 1715, for he says in his edition (p. 175, note 4): 'Hic apud Driffeld in Orientali parte agri Eboracensis sepultus est, ibique monumentum ejus hodie ostenditur.' In Camden's *Britannia* (1600) there is a statement to a similar effect (p. 635): 'Drif-feild, . . . Alfredi eruditissimi Nordanhumbrorum Regis monu-mento . . . notum.'

From all this it appears to follow (1) that Aldfrith not only died at Driffield, but was buried there; (2) that he received his mortal wound in battle; (3) that his tomb, with a Latin inscrip-tion, was to be seen at Little Driffield from before the middle of the 16th century till 1715, or for 165 years; (4) that in Leland's time the monument was already famous, and therefore probably not of recent erection; (5) that it would be difficult to suggest a probable date for the tomb and its inscription after the early part of the eighth century. Startling as such a conclusion may appear, it would follow that Benjamin Franklin might, when he visited England in 1724, have seen the only existing ancient memorial erected to a pre-Alfredian English king, erected at the place where he died.[1] Indeed it seems likely that the tomb was not removed or destroyed before 1808, when, according to Murray's *Guide*, the chapel was partly rebuilt, so that it is barely possible that the inscription might even yet be recovered. This memorial implies such a veneration for Aldfrith, both in his own and subsequent times, as is indeed remarkable, considering the still unsettled con-dition of England at the time of his death, and the vicissitudes through which it has since passed.

[1] Unless one is tempted to make an exception in favor of the mortuary chests in Winchester Cathedral.

Whether or not Driffield, or some place in its vicinity, was a customary residence of Aldfrith, can never, perhaps, be determined. What we do know is that the royal city[1] of Edwin, whether it was at Aldby, near Stamford Bridge, at Malton, or at Londesborough,[2] near Market Weighton, was within twenty miles of Driffield; and certainly Goodmanham, where Coifi profaned his heathen temple,[3] was only a dozen miles away. Twenty miles distant is Flamborough Head, where Ida,[4] the Flamebearer, the first Northumbrian king, is supposed to have landed with his sixty ships in 547. The region, as we see, is associated with some of the most significant events in the earlier history of Northumbria.[5] It would not be surprising, therefore, if somewhere in the vicinity Aldfrith should have habitually dwelt, whether from inclination or from motives of policy. At Beverley, a dozen miles to the south, which, toward the end of his life was to be the favorite abode of St. John of Beverley (d. 721), Aldfrith's friend[6] and fellow-student[7] under Theodore, there was already in the king's lifetime a religious establishment,[8] which John, probably after he became Bishop of York in 705, was instrumental in re-establishing and extending. He was born either at Harpham or Cherry Burton,[9] in either case within a dozen miles of Driffield. A for-

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[1] *Eccl. Hist.* 2. 9.

[2] See Murray, pp. 133, 137, 174; Green, p. 60.

[3] *Eccl. Hist.* 2. 13.

[4] *De Primo Saxonum Adventu* (Simeon of Durham, ed. Arnold, 2. 374): 'Venerat autem Ida . . . cum lx. navibus ad Flemabirig, indeque boreales plagas occupans.' Cf. pp. 310, 313.

[5] For its earlier occupation by the Britons, and the reasons, see the references in note 1, p. 324.

[6] Cf. Leland, *Collectanea*, 2d ed., p. 100: 'Alfridus rex fautor S. Joannis'; Raine (*D. C. B.* 3. 377): 'It was probably owing to King Aldfrith that John was made bishop of Hexham' (Aug. 25, 687). The same influence was probably operative in his elevation to the see of York (705), before Aldfrith died. That he was a favorite with Osred, Aldfrith's young son, at least in the earlier part of his reign, is clear from the account by Folcard (*Histor. Church York* 1. 254-5; cf. Leland, *op. cit.*, p. 101. He consecrated Bede both as deacon (691-2) and as priest (702-3), while Bishop of Hexham (*Eccl. Hist.* 5. 24). He was also an inmate of Whitby in Hild's time (*Eccl. Hist.* 4. 23; Raine, *Fasti Ebor.*, p. 84), and may therefore have known Cædmon.

[7] Leland, p. 100; *Histor. Church York*, p. 244.

[8] Leland, p. 101.

[9] Leland, p. 100; Murray, pp. 139, 157.

est,[1] which gave its earlier name of Inderawood to Beverley, extended all the way from that settlement to Driffield,[2] so that Beverley was known as 'in the wood of the Deirans,'[3] as Driffield is conjectured to mean 'the field of the Deirans.'

Beverley lies near the western boundary of the district of Holderness, which is enclosed between the Wold hills, the North Sea, and the Humber, its greatest length being somewhat less than forty miles, and its extreme breadth about sixteen. Of its 380 square miles of territory, about seventy are marshland, much of which has been reclaimed since the eighteenth century. In this tract have been found many fossil remains of animals, teeth and tusks of the mammoth, elephant's bones and tusks, bones of the red and fallow deer, and, in one place, the head and horns of a great Irish elk.[4] In Waghen Fen, near Beverley, yews, birches, oaks, firs, alders, and hazels, were found lying one over another in extensive layers,[5] reminding one of *Beow.* 1363-4,[6] 'Over it hang groves in hoary whiteness; a forest with fixed roots bendeth over the waters,' just as the tusks of the Elephantidæ may help to account for the *hildetuxum* of *Beow.* 1511, though here the wild boar may also be thought of.[7] When one considers these fens, ancient and modern, it is not surprising that Chaucer should thus characterize the district:

> Lordinges, ther is in Yorkshire, as I gesse,
> A mershy contree, called Holdernesse.

Beverley itself, we should remember, is named from the beavers that frequented it.

Nor is it only in Holderness that such marshland is found hereabouts. Phillips' map discloses great fens between Ouse and Trent—near Thorne, and Goole, and Howden. Of the latter

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[1] This has been described as 'a land of wild forest and waters, interspersed with green pasture-lands' (*Dict. Chr. Biog., loc. cit.*).

[2] Bright, p. 355, note 5. For the antithesis of 'field' and 'wood' see Green, p. 348, note 1; *N. E. D.*, under 'fielden.'

[3] *Eccl. Hist.* 5. 2, 6.

[4] Phillips, pp. 55, 56, 60, 64; Murray, p. 126; White, p. 62.

[5] Phillips, p. 64; cf. White, p. 49.

[6] But cf. p. 332, note 2.

[7] Cf. p. 333, note 2. The walrus, the narwhal, and the swordfish are hardly to be thought of, as not frequenting these waters, though the walrus was not altogether unknown.

neighborhood we are told by Murray[1]: 'The fenny country around Howden, extending to the Ouse and Humber, and formerly called the "Lowths" or low country, as distinguished from the wolds, remained till the end of the last century an unhealthy . . . marsh.' No wonder that the poet of the *Beowulf*, if he lived in this region, was accustomed to think of Grendel and his dam as resorting to the fen, to fen-banks, fen-hollows, fen-lairs, and fen-paths.[2]

But the fen-country is not the whole of the region about Driffield. No less important for our consideration is the great valley of the Wolds, lying W. and N. W. of Holderness; and, still further to the N., the valley of the Derwent. These three, according to Green (pp. 60-61), composed the most ancient Deira: 'Holderness, the Wolds, and the valley of the Derwent, now form the East Riding of Yorkshire; and it is likely enough that this local division preserves, however roughly, the boundaries of the earlier kingdom of the Deirans.' It is not strictly true that the whole valley of the Derwent is included, seeing that that river, 57 miles in length, and rising six miles S. of Whitby, divides the North from the East Riding, the other boundaries of the East Riding being the Ouse, the Humber, and the North Sea. The wolds are thus described by Phillips[3]: 'High and bare of trees, yet not dreary or sterile, they are furrowed, as all other chalk-hills, by smooth, winding, ramified valleys, without any channel for a stream.' Seen from Leavening Brow, about six miles S. W. of Malton, and eighteen N. W. of Driffield, the prospect, according to Phillips,[4] is singular and delightful: 'to the N., purple moorlands, while immediately surrounding us are the green wold hills, crowned with the tumuli and camps of semi-barbarous people, who chased the deer and wild boar through Galtres Forest.' The part of the Wolds bordering on the ocean includes Flamborough Head, with about seven miles of coast to the N. W., and three or four to the S. W., including, as we shall see, some of the boldest coast-scenery in England.

Every attentive reader of *Beowulf* will have been struck by the outstanding character and number of the cliffs and headlands in

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[1] P. 114; cf. p. 95. Howden is about 25 miles from Driffield. Such names as Saltmarshe and Barmby-on-the-Marsh tell their own tale.

[2] *Beow.* 104, 764, 820, 851, 1295, 1359.

[3] P. 50. See also Phillips' map.

[4] Quoted by Murray, p. 160.

the panorama of the poem. Any one who will be at the trouble to look up the words[1] *beorg, clif* (*brim-, ēg-, holm-, stān-, weall-*), *hlið* (*fen-, mist-, næs-, stān-, wulf-*), *næs* (*sǣ-*), and *weall,* with their compounds, can easily convince himself how numerous they are, and, for the picturesqueness of the poem, how important. The 'windy walls' and 'windy headlands' of *Beowulf* (572, 1224, 1358) are as striking as the 'windy Troy' of the *Iliad,* or the 'windy heights' where the Cyclops lived[2] (*Od.* 9. 400; cf. 16. 365). 'Light came from the East, the bright beacon of God,' says Beowulf of the morning after his contest in swimming; 'the waves were stilled, and I could descry the sea-headlands, those windswept walls.' And again, when the eager adventurers were pressing on in their foamy-necked bark toward the home of Hrothgar, at length, on the second day, 'the sailors saw land, gleaming cliffs and lofty hills, broad ocean-headlands.'

When Shakespeare (*K. Lear* 4. 1. 76-7) tells us

> There is a cliff, whose high and bending head
> Looks fearfully in the confined deep,

or again (4. 6. 20-22),

> The murmuring surge,
> That on the unnumbered idle pebbles chafes,
> Cannot be heard so high,[3]

we may be surprised to learn that the Shakespeare Cliff at Dover is only 350 feet high. All the more shall we appreciate the cliff-scenery of the Yorkshire coast. For mere height, the Shakespeare Cliff bears no comparison with the Peak at Boulby, which, according to Phillips, the best of authorities, is not only one of a group which he calls 'stupendously abrupt,' but is 'the loftiest of all the precipices which guard the English coast (660 ft.).'[4] Among cliffs of lesser height is one N. W. of Flamborough (436), and, just beyond this, another of 382 feet; one a short distance S. E. of Boulby Peak (497), Kettleness (375), Huntcliff Nab

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[1] Which can be conveniently done by the help of my *Concordance to Beowulf.*

[2] See below, p. 340.

[3] Cf. Drayton, *Poly-Olbion* 28. 321, on Scarborough.

[4] P. 140; Murray, p. 224. Beachy Head, in Sussex, is 575 ft. high. According to Haigh (*Anglo-Saxon Sagas,* p. 85), Boulby (contracted from 'Bēowulfes beorh,' *Beow.* 2807) = Hronesness (*Beow.* 2805, 3136).

(360), etc.[1] Even Red Cliff (285), though not so high as the Shakespeare Cliff, is called by Phillips 'one of the grandest precipices on the Yorkshire coast.'[2] In one respect, however, the cliffs at Flamborough Head surpass most of those mentioned, in that they, like the Shakespeare Cliff, are composed of white chalk. About the boldness and beauty of the promontory itself there seems to be no difference of opinion among cultivated observers, and this in spite of the fact that it is 100 feet lower than that at Dover. One speaks of 'the grand chalk cliffs of Flamborough Head'; another describes it as 'a great and noble headland'; while still another, approaching it from the south, says: 'At length the whole cliff is chalk from base to summit, and the great promontory, of snowy whiteness, gleams afar in the sunlight along the shores and across the sea.'[3] Not unlike is this, it will be observed, to the 'gleaming cliffs, broad ocean-headlands' of *Beow.* 222-3.[4] Dean Inge somewhere says: 'There are, after all, few emotions of which one has less reason to be ashamed than the little lump in the throat which the Englishman feels when he first catches sight of the white cliffs of Dover.' May not a patriotic Northumbrian, approaching his shores, have experienced a similar emotion in catching sight of the white cliffs of Flamborough?'

But other correspondences remain to be noted. It may excite surprise that (229 ff.) the guard who had been set to watch the coast saw Beowulf and his companions from the cliff,[5] and immediately hurried down to them (cf. 1892, 1914 ff.). It would appear from this that the landing was made at the foot of the

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[1] Cf. Murray, p. xlv; White, p. 127.

[2] P. 116.

[3] Murray, p. xliv; Norway, p. 148, cf. p. 83; White, p. 64. Homer also has a white rock, though mythical (*Od.* 24. 11):

> Passing the Ocean stream and the White Rock's glittering portal.

With the Homeric 'ocean-streams' (*Il.* 3. 5, etc.) cf. *Beow.* 297, 513, 577, 1910, and see below, p. 340. One may note in passing that it was off Flamborough Head that John Paul Jones, in the Bonhomme Richard, captured the Serapis on Sept. 23, 1779.

[4] Cf. Chambers, *Beowulf*, 1921, p. 101: 'It is hardly possible to conceive a greater contrast than that between the Roskilde fjord and the scenery depicted in ll. 1357, etc., 1408, etc.'; similarly Clark Hall, *Beowulf*, p. xxiii.

[5] Cf. the watch on the coast in Queen Elizabeth's time (Norway, p. 85), and the coast-guards of the present day (White, p. 72).

cliff. But, since sailors do not usually select such a spot for a landing-place, it would seem as though this fact might furnish a clue to the topography familiar in the poet's experience. Now one writer tells us that 'from Hull to Whitby there is no natural harbor,' while another speaks of the coast as 'deficient in good and easily accessible harbors.'[1] At Flamborough, however, there are two inlets, the North and the South Cove. These are the only places upon the headland accessible to boats.[2] Without them, according to White, 'the fishermen of Flamborough would have no access to the sea, except by ladders down the precipice; as it is, the declivity is very steep.'[3] Each is described as 'a mere gap in the cliffs.' Notwithstanding the height and steepness of the cliffs, it would have been possible for the coast-guard to hail a vessel from above, for we are told by White that 'it is a peculiarity of Flamborough Head . . . that ships can keep so close in that the men on their decks are distinctly seen, and their voices heard, by one standing on the cliff.'[4]

Near the North Landing, the tourist can be conducted to the caves on this side of the promontory; on the south side, where the water is calmer, they are not found.[5] In some places, caves are formed which open upward to the day.[6] Norway says[7]: 'There may be headlands elsewhere so perforated and tunneled with labyrinthine caves as Flamborough, but I myself have never seen one.' Certain peculiar ones are thus described by White (p. 76):

> In some of the smallest and deepest caverns which curve as they enter the cliff, you get effects of cross-lights from their inner extremity, and see the glistening of the walls, which, worn smooth by the water, appear to be varnished. In all, the floor rises more or less rapidly; and in one, a hundred paces deep, the rush and roar of the surge outside comes only as a gentle murmur.

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[1] Norway, p. 84, cf. p. 133; White, p. 64.

[2] Norway, p. 88.

[3] P. 69. He describes the North Landing as similar to the South, 'but broader, and with an outlet wide enough to be described as a bay' (p. 77).

[4] P. 73. So, too, from the cliffs at Boulby, vessels sail 'so near the shore that you can see plainly the man at the wheel, and the movements of the crew on deck' (White, p. 136).

[5] Phillips, p. 96.

[6] Phillips, p. 92; White, pp. 73, 75, 76; cf. Cleland, *Geology*, pp. 209 ff.

[7] P. 86. Norway comments upon their convenience for smugglers.

Such a cavern, it will be seen, corresponds pretty closely to the scene of the contest between Beowulf and Grendel's dam[1] (1512-8, tr. Clark Hall): 'Then the chief perceived that he was in some unfriendly hall or other, where no water harmed him in any way, nor might the sudden rush of the flood touch him, by reason of the vaulted chamber;—a fiery light he saw, a pallid flame, shine brightly.'

There are difficulties about visualizing the locality of this adventure, but, on the whole, they are not insuperable, if only the water in question is regarded throughout as the ocean, and the *mere*[2] of 1362 is so interpreted; the chief obstacles to thus regarding it lie in the fact that Grendel and his mother are supposed to haunt the moors (103, 162, 710, 1348, 1405), and that the sea-wall seems to be traversed by savage fen-paths (1359).[3] That the stag declines to plunge over the cliff into the ocean need occasion no surprise (1368). A similar inconsistency with respect to Grendel's haunts occurs at 851 (*fenfreoðo*),[4] in a passage (844 ff.) to

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[1] Cf. Brooke, p. 44, note; Clark Hall, *Beowulf*, p. 164. About 8 miles nearly due W. of the extremity of Flamborough Head is the village of Grindale, the 'Grendele' of Domesday Book (cf. Chambers, *Beowulf*, 1921, p. 308).

[2] Over it, we are told, 'hang groves of hoary whiteness; a forest with fixed roots bendeth over the waters' (1363-4); but that this does not suggest a lake or pool is indicated by the parallel passage (1414-6), where it is *mountain*-trees (*fyrgenbēamas*) that overhang the gray rock, just as it is a mountain-stream which goes down (1358-60) under the mists of the cliffs (for such cliff-streams on the Yorkshire coast, see White, pp. 74, 94, 131, 137). No such eyebrows to the ocean-cliffs, like the 'woods that wave o'er Delphi's steep,' are now to be found at Flamborough Head; rather, according to White (p. 73), the region is 'bleak and bare in aspect, rolling away to the distant wolds'; but it is, I presume, conceivable that there may have been trees on the cliffs 1200 years ago.

[3] The Anglo-Saxon mind seems to have been prone to associate fens with moors; thus Alfred (*Boethius*, ed. Sedgefield, 42. 6) translates *paludes* by 'eall þæt his fennas and mōras genumen habbað,' presumably because of a common barrenness. There is no lack of moors within easy reach of Driffield or Flamborough; see Murray, pp. xlv ff., and his map. The wolds, too, superficially resemble the moors (*Encyc. Brit.*, 11th ed., 28. 931).

[4] Here Grendel's fen-lair seems to be in the nickers' mere (845). For a similar confusion see Virgil, *Aen.* 6. 296-7, of which Conington says: 'Acheron has here the Platonic characteristics [*Phædo* 112, 113] of a marshy slough, combined with those of a rapid river'; he also remarks (Vol. 1, p. 22) on the confused scenery of the first *Eclogue* (cf., for example, l. 47

which parallels in detail may be found in 1411 (*nicorhūsa fela*[1]), compared with 1427 (*nicras*), 1416-7, 1422-3 (bloody water). The nickers[2] (422, 575, 1427) must surely inhabit the sea, not a lake or pool.

(Sicilian) with l. 48 (Mantuan). Cf. my paper in *Mod. Lang. Notes* 17. 209-210, and above, p. 328.

[1] That goblins were anciently supposed to haunt caverns along the Yorkshire coast is illustrated by the superstitious beliefs regarding a goblin called Hob-thrush, or Hob-thrust, supposed to inhabit a cavern excavated by the sea in the lias shale at Runswick Bay (Murray, p. 223), while on Rudland Moor, 6 miles N. of Kirkby Moorside, there was formerly a high cairn called Hobthrush's Ruck [heap], and Hob Hurst's House is the name of a sepulchral mound near Hartington in Derbyshire (Murray, p. 267). For the second element of the goblin's name, the *N. E. D.* is inclined to sanction a derivation from ON. *þurs* (OE. *ðyrs*), as suggested by Grimm; for this word see *Beow.* 426, where it = Grendel, and *N. E. D.* under *thurse;* cf. Atkinson, *Glossary of the Cleveland Dialect,* pp. 262-3. In Lancashire, as late as 1700, a thurse-house or thurse-hole signified a hollow vault in a rock or stony hill, which was looked on as enchanted (*N. E. D.*). According to Macquoid, *About Yorkshire*, pp. 349-350, Hob's Hole is a cave 70 feet long, and 20 wide, which the tide fills at high water; and the demon was accustomed to offer to travelers, overtaken by a driving storm at night, the shelter of his cave, where he would leave them to perish by the incoming tide. At Mulgrave Castle, near Whitby, they point out the grave of the giant, Wade; and Kettleness (375 ft. high) was a favorite haunt of the Yorkshire bogles (Murray, p. 223), for which see *N. E. D.* and Atkinson's *Glossary*.

[2] There is undoubtedly a large element of truth in Brooke's theory (pp. 43, 77) that these nickers are pictured from seals, but I can not follow him when he says 'the great seals and walruses,' or 'the tusked seals.' Walruses, I believe, have never resorted to the English coast (cf. p. 327), and of the tusked seal I find no trace anywhere. The *Encyc. Brit.* (11th ed., 24. 534-5) deals at length with only two species of seals which frequent the shores of Britain—the common and the gray seal, the former 4-5 ft. long, and the latter 8 ft. 'All the species frequently resort to sandy beaches, rocks, or ice-floes, either to sleep or to bask in the sun; . . . in the breeding season . . . its [the gray seal's] favorite resort is the inner recess of an ocean-cavern, beyond the reach of the tide.' This, then, confirms *Beow.* 1427, and in a large measure accounts for the scene of 1512 ff. Homer, too, it will be remembered, calls his seals sea-beasts, or monsters of ocean (*Od.* 4. 421, 443, 446, 452), the same word (κῆτος) being elsewhere (*Il.* 13. 27; 20. 147; *Od.* 5. 421; 12. 97) more indefinitely employed (cf *sædēor*, *Beow.* 1510, and see *Beow.* 540, 549, 558). The aquatic monster of which we are told in the life of Columba (2. 28: Reeves, pp. 55-6) was certainly not a seal, but rather a shark, since he bit a swimmer most

The *flōd under foldan* of *Beow.* 1361 is interpreted by Brooke (p. 44) as a mountain-stream which has worn a deep channel, in which the descending stream has made trees grow, and which, coming at length to the edge of the cliff, leaps over in a waterfall. This explanation ignores a marked peculiarity of Yorkshire geology, most noticeable, perhaps, in the N. W. This is noticed by Drayton, *Poly-Olbion* 28. 348-354:

> Towards her dear-lov'd Darwent, who's not gone
> Far from her pearly springs, but underground she goes;
> As up towards Craven Hills, I many have of those
> Amongst the crannied cleeves that through the caverns creep,
> And dimbles hid from day, into the earth so deep
> That oftentimes their sight the senses doth appall,
> Which for their horrid course the people Helbecks call.

And Murray tells us (p. 344) that in the vicinity of Hawes, near the boundary of the North Riding and Westmorland, we may find 'the almost savage solitudes about the sources of the Eden and the Ure. The hills here are dark and rugged, displaying, in Camden's words, "such a dreary waste and horrid silent wilderness that certain little rivulets that creep here are called Hellbecks—rivers of hell." ' And though this is in the N.W. part of Yorkshire, there are general resemblances in the Cleveland district. Thus Phillips, p. 45: 'Some of these dales are very short. . . . Others are rocky channels ploughed some hundreds of feet deep. . . . Such are the principal dales of the Derwent.[1] . . . In several of these valleys the stream loses water, or wholly disappears, when it arrives at the calcareous strata; in approaching the Vale of Pickering, it sinks into the open jointed rocks, . . . the watery currents breaking out again further down the valley.' Two objections may be raised against this theory: the first, that these hell-becks—however appropriate, in their dark mysteriousness, to the demons[2] of flood and fell—are not described as emptying directly, over a cliff, into the sea; and the second, that *foldan* is often interpreted

severely, and afterward rose up from the bottom, and darted after his victim, until Columba stayed him with the sign of the cross. This story may well have been known to Aldfrith, as may that of the whale (1. 13: Reeves, pp. 17-8).

[1] For these see the maps of Phillips and of Murray.

[2] Cf. *Beow.* 101, 852, 1274.

as an accusative. With regard to the latter, it is difficult to understand how 'to a subterranean place' can signify 'down a precipice,' which the context seems to require, unless the dative is accepted.

Whether or not the horse-racing described by Bede (*Eccl. Hist.* 5. 6), which well illustrates *Beow.* 864-7, 916-7, took place near Beverley, as has been supposed,[1] is a matter of conjecture; but at least the hero of the incident was a Yorkshireman,[2] and Yorkshire has long had a reputation both for horses and horse-racing.[3]

VII. ALDHELM AND *BEOWULF*

If Aldhelm, through Aldfrith or otherwise, exerted any influence upon the production of *Beowulf,* it would probably have been twofold in its nature—in advocating that the poet should make good use of such classic models as were accessible to him, and in setting him an example, as the greatest living master of English verse.[4] As to the first, Manitius has filled a dozen pages with

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[1] Cf. Norway, pp. 74 ff.

[2] Cf. p. 326.

[3] Cf. Rice, *History of the British Turf* 2. 24: 'Yorkshire may be regarded, if not as the birthplace of the national sport, yet as the soil upon which horseracing has thriven best. There is no district in the world where the horse is more beloved for his own sake than he is in Yorkshire; there are no people so strongly imbued with a love of the "sport of kings" as the natives of the wide country of York.' Cf. Kinglake, *Eothen*, chap. 4: 'My comrade was a capital Grecian; it is true that his singular mind so ordered and disposed his classic lore as to impress it with something of an original and barbarous character. . . . But Methley [Savile, Lord Pollington, and afterward Earl of Mexborough, with his seat at Methley, near Leeds], abounding in Homer, really loved him. . . . Moreover, he had a good deal of the practical sagacity

Of a Yorkshireman hippodamoio'

[cf. *Il.* 5. 415, etc.]. Of two superior horses in this province we learn from Bede (*Eccl. Hist.* 2. 13; 3. 14).

[4] King Alfred declared that he knew of no one who was Aldhelm's equal in English poetry, according to Wm. Malm., *Gest. Pont.*, p. 336: 'Litteris itaque ad plenum instructus, nativæ quoque linguæ non negligebat carmina; adeo ut teste libro Elfredi de quo superius dixi, nulla umquam ætate par ei fuerit quisquam,' the substance of which has been thus rendered by Montalembert (4. 219): 'These songs in the vernacular tongue retained their popularity for several centuries, and gained for Aldhelm the honor of being

Aldhelm's quotations from Virgil alone,[1] distributed pretty uniformly through his prose and poetry, and even so has not exhausted the number. On the other hand, Klaeber,[2] now ten years ago, published two articles, entitled 'Aeneis and Beowulf,' in which he showed the probability of a decided influence exerted by the Latin upon the English epic. It is tempting to perceive a relation between these two orders of facts. But may not echoes of Homer, too, be found in *Beowulf*, as well as elsewhere in Old English poetry[3]? To take a single example, the comparison of a sailing ship to a bird in flight (217-8) bears a striking resemblance to that in *Od.* 13. 86-8 (cf. 7. 36; 11. 125), and has no parallel in the *Aeneid*. The Old English has: 'So, driven by the wind, the bark most like unto a bird sped, foamy-necked, across the waves'; while the *Odyssey* reads:

> Steadily onward she flew; not even the falcon that soareth,
> Swiftest of birds of the air, might vie with the ship in her swiftness:
> So did she speed on her way, right easily cleaving the billows.

The question suggests itself, then, whether Aldhelm may not have been a mediator of Homer, as well as of Virgil, to Aldfrith and the poet or poets of his court. To have been such a mediator, the first requisite evidently is that he should himself have been demonstrably acquainted with Homer; and this question, I believe, has never been answered,[4] if indeed it has ever been seriously

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proclaimed prince of Anglo-Saxon poetry by the great King Alfred.' This honor will seem the greater when we remind ourselves that, as Chambers has said (*Widsith*, p. 2), 'upon the English poems Alfred the Great was educated; upon them in turn he educated his children; and he was wont to recommend to others the learning of "Saxon" lays by heart'; and again (p. 72): 'King Alfred, we have seen, was deeply versed in Old English poetry, and must have known dozens of lays, lost to us, dealing with the old kings of Angel,' etc. Cf. Asser's *Life of Alfred*, chaps. 22, 75, 76.

[1] Cf. pp. 547-559, especially the first and the last.

[2] *Herrig's Archiv* 126 (1911). 40-48, 339, 359; cf. Brandl, p. 68.

[3] See, for example, my *First Book in Old English* (1894), p. 211, note 6; p. 213, notes 1, 2, 3, 4; p. 230, note 9. Bradley, *Encyc. Brit.*, 11th ed., 3. 758, says that the principal story of *Beowulf* is told 'with a vividness of imagination, and a degree of narrative skill, that may with little exaggeration be called Homeric'; and Chambers admits (*Beowulf*, 1921, p. 329): 'Perhaps, however, some remote and indirect connection even between *Beowulf* and the *Odyssey* is not altogether unthinkable.'

[4] Ehwald (p. XIII) answers it in the negative, but has apparently not scrutinized the simile.

asked. Aldhelm mentions Homer three times by name, but gives no evidence in this way of any first-hand knowledge of the poet. Twice, however—once in verse and once in prose—he employs the simile of a wild boar surrounded by attacking dogs to describe a theological or philosophical disputant in the act of routing a band of adversaries. In one of these the disputant is St. Jerome (*De Virg.* 1649-52[1]):

> Namque canes crebro stipant latratibus aprum,
> Undique vallantes densa cingente corona,
> Ast ille infestos dispergit dente[2] molosos,
> Et voti compos saltu regnabit in alto.

Which may be thus translated: 'Thus dogs often surround a wild boar with their barking, encompassing him on every side with a dense ring; but he scatters the worrying hounds with his tusk, thenceforward to hold sway in the high woodland at his own pleasure.'

In the other, the champion is Theodore of Tarsus (*Epist. ad Eahfr.*[3]): 'Etiamsi Theodorus, . . . Hibernensium globo discipulorum, ceu aper truculentus molosorum catasta [caterva?] ringente vallatus, stipetur, limato perniciter grammatico dente, . . . rebelles falanges discutit.' This would be in English: 'Although Theodore is ringed in by a crowd of Irish students, like a fierce wild boar besieged by a snarling pack of hounds, when, all of a sudden, he whets the tusk of scholarship, he puts to flight those rebellious hordes.' Ovid, though he is rather fond of introducing the wild boar into his verse,[4] has no close parallel to these; nor has Virgil, except in *Aen.* 10. 707 ff.[5]:

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[1] Giles, p. 180; Ehwald, p. 421.

[2] Cf. *Gn. Ex.* 19-20: 'Eofor sceal on holte tōðmægenes (*l.* tōðmægene) trum.'

[3] Giles, p. 94; Ehwald, p. 493.

[4] Thus *Met.* 1. 305; 8. 338 ff.; 10. 713 ff.; *Ep.* 4. 104; *F.* 2. 231-2; *A. A.* 2. 373-4; but cf. *G.* 3. 255, 411-2; *Aen.* 9. 551, etc.

[5] 'And like a wild boar driven from the high hills by biting hounds, . . . when he is among the toils, he stands at bay, and rages fiercely, and raises his bristles on his back; not a man has the courage to show anger or approach nearer, but they attack with darts thrown from afar, and shouts in which there is no risk, whilst the undaunted beast turns deliberately on every side, gnashing with his teeth, and shaking the spears from his back.' (Tr. Lonsdale and Lee.) Cf. 13. 471-5; 18. 583-6 (of a mountain-lion).

Ac velut ille canum morsu de montibus altis
Actus aper, . . .
. . . postquam inter retia ventum est,
Substitit, infremuitque ferox et inhorruit armos;
Nec cuiquam irasci propriusque accedere virtus,
Sed jaculis tutisque procul clamoribus instant.
Ille autem impavidus partis cunctatus in omnis,
Dentibus infrendens, et tergo decutit hastas.

An attentive comparison will show that this can hardly be regarded as Aldhelm's original, however partial he is to Virgil. Any one of two or three passages from the *Iliad* would have served as an exacter model. So this (17. 725-8): 'Charged like *hounds that spring* in front of hunter-youths *upon a* wounded *wild boar, and for a while run in in haste to rend him, but when he wheeleth round among them*, trusting in his might, *then they give ground*, and shrink back here and there.' Or this (11. 414-8): '*And even as when hounds* and young men in their bloom *press round a boar*, and he cometh forth from his deep lair, *whetting his white teeth* between crooked jaws, *and round him they rush*, and the sound of the gnashing of tusks ariseth, and straightway they await his assault, so dread as he is,' etc. And it is entirely reasonable to suppose that Aldhelm, who had been a pupil of Theodore,[1] may through him have become acquainted with Homer, whom Theodore must almost certainly have read during his studious years at Athens, if not earlier.

As for the example which Aldhelm, in his capacity as author, set the English people, it will be sufficient to quote these sentences from Green[2]: 'He had become a master of all the knowledge of his day, and the rising scholar-world of Kent and Northumbria welcomed his Latin poems and prose. . . . He was the first singer of his race. . . . The songs of Aldhelm led the way in that upgrowth of popular poetry which was soon to fill the land with English verse. Creed, prayer, riddle, allegory, acrostic, Bible-story and saint-story, hero-tale and battle-tale, proverb and moral saw, the longing of the exile, the toil of the seaman, the

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[1] Cf. the subscription to Ceadwalla's charter of 680 (*Cart. Sax.* 1. 83; Ehwald, p. 511): 'Ego Aldhelmus, scolasticus archiepiscopi Theodori'; similarly, 'Theodori rethoris discipulo' (Ehwald, p. 51). On the possibility that Aldfrith may have had some knowledge of Greek, see above, p. 311.

[2] Cf. pp. 336-7.

warning of the grave, passed alike into rhyme. It was with an ever-growing stock of ballads that the gleeman trolled his way from fair to fair.'

VIII. *BEOWULF* AND THE HOMERIC POEMS

On the theory that we ought not to be surprised if Homeric influence is discernible in *Beowulf*, we may properly inquire whether, in addition to the parallel adduced above, clear traces of this influence are actually to be found. Such clear traces I discern at the close of *Beowulf*, where the hero's funeral and monument are described, as compared with those near the end of the *Iliad* and the *Odyssey* which depict the obsequies of Patroclus, Hector, and Achilles. These may be briefly presented under seven heads, in the order of the Beowulfian passages:

(1) Beowulf chooses the headland where his tumulus is to be erected (2802-8, 3096-8; cf. 3135-6, 3156-8). So Achilles (*Il.* 23. 125-6, 244-8; *Od.* 24. 76 ff.; cf. *Il.* 7. 85; *Od.* 12. 11).

(2) Orders are issued to collect wood for the pyre (3110-3). So by Agamemnon (*Il.* 23. 110 ff.), and by Priam (*Il.* 24. 777-781).

(3) For Beowulf a 'firm-built' pyre is prepared (3138). For Patroclus abundant wood is piled, and the pyre is a hundred feet square (*Il.* 23. 127, 139, 164).

(4) Beowulf is laid in the middle of the pyre (3141), as is Patroclus (*Il.* 23. 241). This, it must be confessed, is one of the weakest of the parallels, though Achilles himself emphasizes the position.

(5) Achilles having prayed to Boreas and Zephyrus to cross the seas, and fan the laggard flames of the pyre (*Il.* 23. 193 ff.), they perform their mission, and then, at the coming of dawn, betake them home over the Thracian main while the flame dies down (*Il.* 23. 228-230). So at the burning of Beowulf the blazing fire roared, mingled with a sound of weeping *when the tumult of the wind was stilled* (3146).

(6) The aged wife of Beowulf utters a lament for her husband (3150-5), as does Andromache over Hector (*Il.* 24. 723-745). That of Andromache is much longer, partly because of her concern for her child.

(7) The construction of Beowulf's grave-mound occupies ten days (2159). For Hector, ten days are spent in the rearing of the pyre and the burning of the body (*Il.* 24. 664-5, 784-5), only one day more being allowed for the building of the barrow, since on the twelfth day the Trojans must expect a renewal of hostilities.[1]

Chadwick argues (p. 53) that the account of Beowulf's obsequies proves that the poem was originally a heathen work; but if this part of it was elaborated under Homeric influence, and particularly if this influence were due to suggestion emanating either from Aldhelm or directly from Aldfrith, this contention would lose its force, as Chadwick himself, who has adduced a number of similarities between Homer and the *Beowulf*,[2] would doubtless be the first to acknowledge. It is true that Jordanes' account[3] of the funeral of Attila has certain features in common

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[1] With the exception of (3)—for which see *Aen.* 6. 177-8, 215—the corresponding portions of the *Aeneid* do not provide such prototypes. The apostrophes of Aeneas (11. 42-58) and of Evander (*Aen.* 11. 152-180) to the dead body of Pallas do not supply the requisite correspondence to (6). The footmen who, in *Aen.* 11. 188-190 (following *Od.* 24. 68-70), are associated with the horsemen that circle round the pyres, are found neither in *Il.* 23. 13 nor in *Beow.* 3169. With the typical number of the horsemen in *Beowulf* cf. *Il.* 18. 336; 21. 27; 23. 22, 175, 181, the number of the Trojan youth sacrificed at the pyre of Patroclus, though possibly there is association with the number of the Apostles (cf. *Beow.* 2401 with *Gu.* 681; *An.* 2, etc.); this number does not occur in Virgil.

[2] Cf. pp. 320 ff. (also 76). Chadwick's comparisons are these (some being of mere phrases): *B.* 194, etc.: *Il.* 23. 113 ff.; *B.* 205 ff.: *Od.* 4. 778 ff.; *B.* 237 ff., 251 ff.: *Od.* 1. 169 ff.; 3. 71 ff.; *B.* 320 ff.: *Od.* 4. 20 ff.; *B.* 428, 663: *Il.* 3. 229, etc.; *B.* 371, etc., 529, etc.: *Il.* 1. 130, etc.; 4. 317, etc.; *B.* 480 ff.: *Il.* 20. 83 ff.; *B.* 520 ff.: *Il.* 12. 243; 15. 494 ff.; 24. 499-500; *B.* 610, etc.: *Il.* 2. 243, etc.; *B.* 697: *Od.* 3. 208; 7. 196 ff.; *B.* 791, etc.: *Il.* 8. 80, etc.; *B.* 856 ff., 1221 ff.: *Od.* 4. 724 ff.; 9. 20; *B.* 920 ff.: *Od.* 1. 328 ff.; *B.* 1050, 2338: *Il.* 1. 7, etc.; *B.* 1195 ff.: *Il.* 6. 235-6; *B.* 1359: *Od.* 16. 365; *B.* 1369 ff.: *Il.* 15. 271 ff.; *B.* 1388, etc.: *Il.* 9. 189, 524; *B.* 1870 ff.: *Od.* 16. 14 ff.; *B.* 2124 ff.: *Il.* 7. 79-80, etc.; *Od.* 11. 71 ff.; *B.* 2184: *Il.* 1. 162, etc.; *B.* 2634 ff., 2646 ff.: *Il.* 16. 270-2; *B.* 2694 ff.: *Il.* 5. 252 ff.; *B.* 2802 ff.: *Il.* 7. 85 ff.; *Od.* 24. 80 ff.; *B.* 2814 ff.: *Od.* 14. 180-1.

[3] Chap. 49: 'His body having been deposited under a silken pavilion in the midst of the plain, a solemn spectacle was exhibited for the admiration of all beholders. For, while horsemen chosen from the whole body of the Huns moved in ordered evolutions, as if in the games of the circus, over

with that of Beowulf, but against this must be set the differences, and the possibility that the Huns might have become acquainted with the Homeric tradition through their contacts with the Eastern Empire.[1] In the last two lines of the poem, Beowulf is represented as not only Christian, but Christlike, in every phrase except the last, and in that, what may be called the virtually ineradicable pagan trait, love of fame, bears a close resemblance to one exhibited by the Christian Aldhelm.[2]

Another illustration of Homeric influence may perhaps be detected in *Beow.* 856 and 865. In the former, warriors are represented as riding on white horses[3]; in the latter, on 'fallow'

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the ground where he lay, his achievements were recited in the following dirge: "Attila, the eminent king of the Huns, the son of Murdzuk, and lord of the most valiant of all peoples, acquired, by an ability previously unexampled, sole dominion over the Scythian and German realms, and so terrified both Roman empires by the capture of their cities that their entreaties moved him to accept their annual tribute in lieu of further spoliation. And, when he had accomplished all this by virtue of a rare good fortune, he died, not as one smitten by his foes or betrayed by his subjects, but in the midst of rejoicing by the nation which he had established in security, himself in high spirits and with no touch of pain. Who can think of this as death, since for it there is no occasion to exact vengeance?" When these lamentations had ceased, they celebrated the so-called *strava* over his tumulus with unrestrained festivities, thus mingling revelry with funereal grief [cf. *Il.* 665, 802]. Then, in the dead of night, they committed his body to the earth.' The corresponding Beowulfian passage is (3169-72): 'Then warriors, sons of princes, twelve in all, rode round about the mound; they would bewail their sorrow, mourn their king, utter the dirge, and speak of their hero.' But this is not unlike *Od.* 24. 68-70: 'Many heroes of the Achæans moved mail-clad around the pyre when thou wast burning, both footmen and horse, and great was the din that arose.'

[1] For the knowledge of Homer in the Greek colony of Olbia (rebuilt after 248) among the Getæ of about 83 A. D., see Dio Chrysostom, *Orat.* 36.

[2] Cf. above, p. 299, note 1. Æthelfrith, the father of three Northumbrian kings, and the grandfather of Aldfrith, is characterized by Bede (*Eccl. Hist.* 1. 34) as 'gloriæ cupidissimus,' which the Alfredian translator renders by 'se gylpgeornesta.' This epithet applies in a remarkable degree to the whole Northumbrian dynasty from Æthelfrith to Aldfrith, inclusive. Alfred, an unusual Christian for those or any times, did not hesitate to declare (*Boethius*, ed. Sedgefield, p. 41): 'This it is that I have desired—to live worthily while I lived, and after my life to leave to the men who should follow me my memory in good deeds.'

[3] *Blanca,* 'white horse,' sometimes, perhaps, shading off into 'noble horse' (see Tupper, *Riddles of the Exeter Book*, p. 119), or simply 'horse,' as

steeds.[1] Now, whatever 'fallow' may precisely mean, it must denote a light color, rather than a dark. The *N. E. D.* defines it, 'of a pale brownish or reddish yellow color'; this, in the case of horses, would suggest sorrel, or chestnut, rather than bay. White and sorrel horses, then, were in the poet's mind as he wrote. Virgil explicitly stamps both of these sorts as inferior in *G.* 3. 82-3, though in *Aen.* 12. 84, under the influence of Homer (*Il.* 10. 437), he seems to retract, at least for the moment, so far as white horses are concerned. Homer is no less clear in his admiration of sorrels or chestnuts, if we may thus translate the φοῖνιξ of *Il.* 23. 454,[2] and the ξανθά, ξανθάς of *Il.* 9. 407; 11. 680.[3] In the first of these, Diomedes is unexpectedly winning in the chariot-race, and all is excitement; the chief of the Cretans hears a shout afar off, and then becomes 'aware of a horse showing plainly in the front, a chestnut (Seymour, sorrel) all the rest of him, but in the forehead marked with a star.' A few moments later, Diomedes 'drew up in the mid concourse, and much sweat poured from the horses' heads and chests to the ground,' while 'Diomedes leapt to earth from the shining car, and leant his lash against the yoke.' It follows that if the poet of *Beowulf* was influenced by either ancient in this point, it was by Homer[4] rather than Virgil.

For nearly three hundred years, Old English poetry from time to time represented the march of armies and the slaughter of battle-fields as attended by the jubilant cries of wolf, raven, and eagle. In no fewer than six poems, exclusive of the *Beowulf*, we find such passages—in the *Genesis* (1983-5), *Exodus* (161 ff.), *Elene* (27-30, 52-3, 110-3), *Judith* (205-212, 296-7), *Brunanburh* (60-65), and *Byrhtnoth* (106-7), the last bearing the date of 991. These vigorous descriptions suggest at once the excitement and the horror of war, in this respect far outclassing the Homeric lines which merely refer to becoming the spoil and prey of dogs,

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equus albus into 'fleet horse' (e. g. in Horace, *Sat.* 1. 7. 8, where see Rolfe's note), possibly from association with *Il.* 10. 437, through *Aen.* 12. 84.

[1] For Cosijn's emendation of *fealwe to fealwum* in 916, see Chambers' note on the line.

[2] As Seymour does (*Life in the Homeric Age*, p. 352), Lang, Leaf, and Myers, and Bryant.

[3] As by Lang, Leaf, and Myers.

[4] For Bede's knowledge of Greek, see Plummer 1. liv; cf. Chambers, *Beowulf*, 1921, p. 329.

birds, wild beasts, birds and beasts, or dogs and winged fowls (*Il.* 1. 4; 17. 272; *Od.* 3. 271; 5. 473; 24. 292; cf. Aeschylus, *Suppl.* 800; Sophocles, *Ajax* 830).[1] Of these, the most accessible to a beginner in Homer would naturally be *Il.* 1. 4, where the wrath of Achilles is represented as giving the bodies of heroes to be 'a prey to dogs and all winged fowls.' Now, the first in order of Old English poets to have his imagination fired by this picture—if indeed we allow that he received the impulse from Homer—was the author of *Beowulf,* who thus bettered his borrowing[2] (3024-7). 'But the black raven, poised in flight from the battle-field (*lit.* ready to depart above the dead), shall chatter without end to the eagle of how he sped at the feast, where he wrenched away the slain from[3] the wolf.' With this before them, the later poets dealt with the conception as they were able, for the most part dwelling upon the yelp, or croak, or scream of beast and bird under the figure of a song. In dramatic vividness, it is clear, the author of *Beowulf* surpassed all his successors.

IX. THE COMPOSER OF *BEOWULF*

After all, who was the composer of the *Beowulf?* I presume no one will expect me to answer this question. What I have endeavored is to suggest the probable agency of King Aldfrith in prompting, encouraging, and otherwise aiding the poet—very likely a courtier—in his undertaking. As to how the foreign material was acquired, and then shaped and modified in detail, I have nothing to offer beyond what will inevitably occur to any serious student of the poem who is inclined to regard its present form as pretty faithfully representing, apart from dialectal changes, what issued from the hands of its author in the earliest decade or decades of the eighth century. That Aldfrith himself ever saw or heard the poem in its absolutely final form will not

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[1] Cf. Gildas, *De Excidio Britanniæ* 24; Salvian, *De Gubernatione Dei,* ed. Pauly, 6. 15. 84.

[2] More graphic than Homer are Job 39. 28-30; Prov. 30. 17 (cf. Matt. 24. 28; Lk. 17. 37).

[3] Grimm (*Andreas und Elene,* p. XXVI) misinterprets *wið wulf* (*e*) *wæl rēafode* as '*una cum lupo* cadavera spolianti,' and has been followed by various editors and translators.

seem likely to any one who admits the probability that the king is figured, in certain respects, by the Beowulf of the closing scenes. But that he must have heard many parts of the poem, perhaps repeatedly, seems to me possible enough, and in that case his applause and criticism would doubtless have contributed materially to the excellence of the existing poem. How dependent a minstrel could be upon an appreciative and qualified patron is shown by the last lines of the *Widsith*, as well as what such a patron, if a man of deeds and station, had to expect from the singer:

> South or north they [the gleemen] ever meet with one skilled in songs, bounteous in gifts, who desires to exalt his fame before his chieftains[1]—to do deeds of honor till all departs, life and light together; he gaineth glory, and hath under the heavens the honor which passeth not away.[2]

That a court-minstrel (cf. 1066; *Deor's Lament* 36-39) should exalt a monarch or hero to his face was not unexampled. The qualifications of such a minstrel are well exhibited in *Beow.* 867-874[3]:

> At times one of the king's thanes, laden with boasts,[4] mindful of songs, who knew old tales without number, invented a new story, closely bound up with fact; the man deftly narrated the adventure of Beowulf, and cunningly composed[5] other skilful lays[6] with interwoven words.[7]

According to this, the minstrel must

(1) have great store of legends and olden tales (cf. 89 ff., 2106, 2109-10);

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[1] Chambers' note: 'before the assembled company.'

[2] Chambers' translation; Chadwick renders the close (p. 87): 'He who wins praise shall have his glory established on high beneath the sky.'

[3] According to William of Malmesbury (*Gest. Pont.*, p. 336), it was to the credit of Aldhelm that he was equally skilled in the composition of verse and its accompanying music, and that, according to circumstances, he could either chant or declaim his English poems: 'Poesim Anglicam posse facere, cantum componere, eadem apposite vel canere vel dicere.'

[4] Chambers suggests 'laden with glorious words,' or (after Klaeber), 'covered with glory.'

[5] Rather, perhaps, 'poured forth.'

[6] Cf. 1159-60, 2446-7.

[7] I suggest 'develop, unfold with words,' with the notion, perhaps, of rhetorical expansion and diversification (cf. Gr. ποικίλλειν).

(2) be expert in musical recitation (cf. 90, 496, 1063) of the lays he knew;

(3) be quick and skilful in extemporizing on a new theme (cf. Chadwick, pp. 83, 87).

X. THE COMPOSER OF *WIDSITH*

My brief discussion of *Widsith* may be introduced by a few extracts, bearing chiefly upon the question of date, from Chambers' edition of 1913. After an examination of various critical remarks upon the poem, Chambers continues (pp. 150-1): 'We have an exceedingly early poem, belonging probably to the seventh century, but reflecting the traditions of the fifth and sixth. . . . *Widsith* has been interpolated. . . . It may be well to make a list of the passages open to suspicion. . . . In this schedule of suspected passages we must place the Biblical interpolation [82-4], with the other lines condemned by Müllenhoff (ll. 14-17, 75-87, 131-4),' etc. Again he says (pp. 178-9): '*Widsith* seems to belong to a period . . . earlier than *Beowulf* or *Genesis:* that is, to the seventh century. This, too, is the date which . . . has been widely accepted, but not universally, because the view has hitherto been entertained that the language and metre of *Widsith* pointed rather to the eighth than the seventh century. . . . Our poem owes its preservation, where so much has been lost, to the fact that it interested a monkish scribe, probably because of its encyclopædic geographical information. But the world of this scribe was very different from that of the tribal bard who first devised the lay.' With reference to this scribe, Chambers identifies him (p. 4) with the transcriber of the Exeter Book, and in another place (p. 9) speaks of 'the tenth-century English monk whom we suppose to have interpolated lines 82-84.'

Reduced to the barest outline, a summary of these statements might be:

(1) The opinions of the critics, for the most part, assign the *Widsith* to the seventh or eighth century.

(2) The interpolation of lines 82-4 may be as late as the tenth century.

Lines 82-4 are thus translated: 'With the Israelites I was and with the Assyrians, with the Hebrews, with the Indians, and with the Egyptians. With the Medes I was, with the Persians, and with the Myrgings.'

It being understood that I am referring to the poem with its present compass, I submit that the contention between the critics as to its date might be sufficiently resolved by assigning *Widsith* to the latter part of Aldfrith's reign, and that that monarch's known interest in Biblical and Oriental geography[1] would account for the inclusion of the lines I have translated. Furthermore, the occurrence in both *Widsith* and *Beowulf* of such names as Offa, Hroðgar, Hroð(w)ulf, Heaðobeardna, Heorot(35-49),[2] Bre(o)ca (25), Bronding-(25),[3] would seem to warrant the assumption of a similar date and provenance, if not of common authorship, for the two poems. Moreover, the remarkable hemistich (79), 'With the Scots I was and with the Picts,' renders it fairly certain that the author was an Englishman,[4] and one especially interested in those peoples, as a Northumbrian in Aldfrith's reign would have been, because of Ecgfrith's dire defeat at their hands in 685,[5] and the encouragement which that gave them to pursue their advantage. The mention of Wada (22) recalls the giant, Wade, whose traditional home is localized near Mulgrave Castle.[6] Finally, there is no good reason why the name of Alexander the Great should not have been known to Aldfrith, nor that he should have been incapable of the characterization in 15-17: 'Alexander [was] most mighty of all the race of men, and flourished most of those of whom I have heard tell throughout the world.'

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[1] See above, pp. 302-5.

[2] Cf. Chambers, *Widsith*, pp. 79 ff.

[3] Cf. Chambers, *op. cit.*, pp. 110-111. Add Fin Folcwalding (27), with which cf. *Beow.* 1089, 1096, etc.; and see Chambers, *op. cit.*, p. 67. Then Ongen(d)ðeow (31), *Beow.* 2486, etc.; cf. Chambers, *op. cit.*, p. 200.

[4] Cf. Chambers' note on the line.

[5] Cf. pp. 322-3.

[6] See above, p. 333, note 1; Chambers, *op. cit.*, pp. 97-8.

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THE REPUTATION OF CHRISTOPHER MARLOWE

I. TO THE CLOSING OF THE THEATRES (1642)

The first literary reference to Marlowe, as to Shakespeare, appears to be due to the envy of Robert Greene. Some four and a half years before he penned the famous reference to Shakescene in his *Groatsworth of Wit*, Greene introduced the following cryptic passage into the epistle 'to the gentlemen readers' of his *Perimedes the Blacksmith*, licensed March 29, 1588, and published the same year:

> I keepe my old course, to palter vp some thing in Prose, vsing mine old poesie still, *Omne tulit punctum*, although latelye two Gentlemen Poets made two mad men of Rome beate it out of their paper bucklers: and had it in derision, for that I could not make my verses iet vpon the stage in tragicall buskins, euerie worde filling the mouth like the faburden of Bo-Bell, daring God out of heauen with that Atheist *Tamburlan*, or blaspheming with the mad preest of the sonne: but let me rather openly pocket vp the Asse at *Diogenes* hand: then wantonlye set out such impious instances of intollerable poetrie, such mad and scoffing poets, that haue propheticall spirits as bred of *Merlins* race, if there be anye in England that set the end of scollarisme in an English blanck verse, I thinke either it is the humor of a nouice that tickles them with selfe-loue, or so much frequenting the hot house . . .[1]

Though much of this has now lost its meaning, two things are clear: that the splendor of the blank verse in *Tamburlaine* had already taken the town and left at least one of Marlowe's competitors sick at heart; and that his bold speculative attitude toward religion was being branded as 'atheism' by the bigoted orthodoxy of the age. Although Marlowe's name is not precisely mentioned—just as Shakespeare's is not in the *Groatsworth* passage—the pun implied in 'Merlin's (Marlin's[2]) race' seems as obvious as that

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[1] References for the passages cited in the following pages are generally to the standard modern editions. Where these do not employ the original spelling and punctuation—as in Shakespeare, Beaumont and Fletcher, Jonson, Hazlitt's Dodsley—the quotations ordinarily follow modern usage.

Many of the allusions to Marlowe have been noted by earlier students. Particular acknowledgment is due to the manuscript memoranda of Malone and James Broughton, Dyce's *Account of Marlowe and his Writings* (1850), E. Koeppel's *Marlowe im Spiegel des Dramas* (Anglistische Forschungen 20, 1906), and Alexander Tille's *Faustsplitter* (1900).

[2] Marlin is the name by which the poet is known in most of the Cambridge records.

intended in the allusion to 'the onely Shake-scene in a countrie.' In this earliest reference, then, Greene very neatly caught the two sides of Marlowe's reputation which piqued the imagination of his contemporaries. They continued to think of him chiefly either as the creator of the mighty line or as the reckless utterer of atheistic iconoclasm.

No new element, beyond the deeper strain of moral admonition, is found in the words which Greene addresses to Marlowe in the *Groatsworth of Wit* (1592):

> Wonder not, (for with thee wil I first begin), thou famous gracer of Tragedians, that *Greene*, who hath said with thee like the foole in his heart, There is no God, should now giue glorie vnto his greatnesse: for penitrating is his power, his hand lies heauie vpon me, he hath spoken vnto me with a voice of thunder, and I haue felt he is a God that can punish enimies. Why should thy excellent wit, his gift, be so blinded, that thou shouldst giue no glory to the giuer? Is it pestilent Machiuilian pollicie that thou hast studied? O punish follie! What are his rules but meere confused mockeries, able to extirpate in small time, the generation of mankinde. For if *Sic volo, sic iubeo*, hold in those that are able to command: and if it be lawfull *Fas & nefas* to doe any thing that is beneficiall, onely Tyrants should possesse the earth, and they striuing to exceede in tyranny, should each to other bee a slaughter man; till the mightiest outliuing all, one stroke were left for Death, that in one age man's life should ende. The brother of this Diabolicall Atheisme is dead, and in his life had neuer the felicitie he aimed at: but as he began in craft, liued in feare, and ended in despaire. *Quam inscrutabilia sunt Dei iudicia?* This murderer of many brethren, had his conscience seared like *Caine*: this betrayer of him that gaue his life for him, inherited the portion of *Iudas*: this Apostata perished as ill as *Iulian*: and wilt thou my friend be his Disciple? Looke vnto me, by him perswaded to that libertie, and thou shalt finde it an infernall bondage. I knowe the least of my demerits merit this miserable death, but wilfull striuing against knowne truth, exceedeth all the terrors of my soule. Defer not (with me) till this last point of extremitie; for little knowest thou how in the end thou shalt be visited.

Though again Marlowe is not named, it is hardly possible to doubt that he is here meant; and it is equally probable that it is he whom Chettle's *Kind-Harts Dreame* (December, 1592) couples with Shakespeare as having protested against the tone of Greene's address, and of whom Chettle proceeds to speak very cavalierly: 'With neither of them that take offence was I acquainted, and with one of them I care not if I neuer be.' Then Chettle inserts his famous apology to Shakespeare and returns to Marlowe: 'For the first, whose learning I reuerence, and, at the perusing of

Greenes booke, stroke out what then in conscience I thought he in some displeasure writ, or, had it beene true, yet to publish it was intollerable, him I would wish to vse me no worse than I deserue.'

From the last sentence it appears that the discretionary power which Chettle allowed himself with Greene's posthumous production may have deprived us of some specific scandal regarding Marlowe, but it is unlikely that we have lost anything possessing evidential value. It is to be observed that Greene charges Marlowe in 1588 and again in 1592 with Machiavellian or atheistic principles and with nothing further. Such seems to be the sole moral accusation against him prior to his death, save that the indictment of the informant Baines adds that Marlowe spoke in approval of paederastic indulgence and of the counterfeiting of coinage. There is perhaps ground for doubting whether this testimony is fair to the poet; but even if accepted at its face value, it charges him only with vicious opinions. Vicious life (as distinct from opinions) seems not to have been imputed to him while he lived. Gabriel Harvey's *New Letter of Notable Contents* (dated Sept. 16, 1593) emphasizes the point in a neat antithesis: 'Though *Greene* were a Iulian, and *Marlow* a Lucian: yet I would be loth, *He* (i. e., Nashe) should be an Aretin.'[3]

Kyd, writing like Harvey shortly after the poet's death, and when he was much put to it to discredit the idea that he was under Marlowe's influence, adds some new ungracious touches. Not only was Marlowe irreligious, he says, but cause why he should be loved 'neither was in him for p(er)son, quallities or honestie, besides he was intemp(er)ate & of a cruel hart.'[4] Naturally,

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[3] How far Marlowe really was a Lucian, *i. e.*, a total disbeliever in religion, was later debated by Warton and Ritson. See page 392.

In *Pierces Supererogation* (1593), Harvey refers to 'no Religion, but precise Marlowisme.' For other allusions by Harvey to Marlowe see Grosart's Harvey, i. 292 ('*Greene*, and *Marlow* might admonish other to aduise themselues'); ii. 115 ('Marlowes brauados'); ii. 322 (Nashe 'odiously misuseth euery frend, or acquaintance as he hath serued . . . Greene, Marlow, Chettle, and whom not?'). For Nashe's vindication of his friendship for Marlowe, and his censure of Harvey's dispraise of the latter, see below, p. 359, note 11.

[4] In his later letter, recently printed by Mr. F. K. Brown (*Times Literary Supplement*, June 2, 1921), Kyd blames both Marlowe's rash talk and 'his other rashnes in attempting soden pryvie iniuries to men.' The impres-

Marlowe's reputation suffered yet more when the sudden and mysterious death of the 'atheistical' playwright made it convenient for Puritan pamphleteers to use his character to point a moral. The first of these was Richard Beard in chapter xxv of his *Theatre of Gods Iudgements* (1597):

Not inferiour to any of the former in Atheisme & impiety, and equall to all in maner of punishment was one of our own nation, of fresh and late memory, called *Marlin* [marginal note: *Marlowe*], by profession a scholler, brought vp from his youth in the Vniuersitie of Cambridge, but by practise a playmaker, and a Poet of scurrilitie, who by giuing too large a swinge to his owne wit, and suffering his lust to haue the full raines, fell (not without iust desert) to that outrage and extremitie, that hee denied God and his sonne Christ, and not only in word blasphemed the trinitie, but also (as it is credibly reported) wrote bookes against it, affirming our Sauiour to be but a deceiuer, and *Moses* to be but a coniurer and seducer of the people, and the holy Bible to be but vaine and idle stories, and all religion but a deuice of pollicie. But see what a hooke the Lord put in the nosthrils of this barking dogge: It so fell out, that in London streets as he purposed to stab one whome hee ought a grudge vnto with his dagger, the other party perceiuing so auoided the stroke, that withall catching hold of his wrest, he stabbed his owne dagger into his owne head, in such sort, that notwithstanding all the meanes of surgerie that could be wrought, hee shortly after died thereof. The manner of his death being so terrible (for hee euen cursed and blasphemed to his last gaspe, and togither with his breath an oth flew out of his mouth) that it was not only a manifest signe of Gods iudgement, but also an horrible and fearefull terrour to all that beheld him. But herein did the iustice of God most notably appeare, in that hee compelled his owne hand which had written those blasphemies to be the instrument to punish him, and that in his braine, which had deuised the same. I would to God (and I pray it from my heart) that all Atheists in this realme, and in all the world beside, would by the remembrance and consideration of this example, either forsake their horrible impietie, or that they might in like manner come to destruction: and so that abominable sinne which so flourisheth amongst men of greatest name, might either be quite extinguished and rooted out, or at least smothered and kept vnder, that it durst not shew it head any more in the worlds eye.[5]

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sion of the poet's temerarious conduct would be enhanced by the circumstances of his death.

[5] *The Theatre of Gods Iudgements: Or, A Collection of Histories out of Sacred, Ecclesiasticall, and prophane Authours, concerning the admirable Iudgements of God vpon the transgressours of his commandements. Translated out of French, and Augmented by more than three hundred Examples, by Th. Beard.* The obvious error, by which Marlowe's death is stated to have occurred 'in London streets,' is omitted in the 1612 edition; but it recurs in Edmund Rudierde's abridgment, *The Thunderbolt of Gods Wrath*

Francis Meres incorporated Beard's account and his moral in the *Palladis Tamia* (1598):

As *Iodelle*, a French tragical poet beeing an Epicure, and an Atheist, made a pitifull end: so our tragicall poet *Marlow* for his Epicurisme and Atheisme had a tragicall death; you may read of this *Marlow* more at large in the *Theatre of Gods iudgments*, in the 25. chapter entreating of Epicures and Atheists.

Hereupon Meres adds a further account, discordant with that in Beard, and unsubstantiated by any other authority:

As the poet *Lycophron* was shot to death by a certain riual of his: so *Christopher Marlow* was stabd to death by a bawdy Seruing man, a riuall of his in his lewde loue.

This is the only record relating to Marlowe which accuses him of lewdness. It was taken over, a century later, and embroidered by Anthony Wood,[6] and has, not surprisingly, proved vastly attractive to modern imaginative 'restorers' of the poet's life history.

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against Hard-Hearted and stiffe-necked sinners (1618), which reads as follows (chapter xxii, p. 29):

'We read of one *Marlin*, a *Cambridge* Scholler, who was a Poet, and a filthy Play-maker, this wretch accounted that meeke seruant of God *Moses* to be but a Coniurer, and our sweete Sauiour but a seducer and a deceiuer of the people. But harken yee braine-sicke and prophane Poets, and Players, that bewitch idle eares with foolish vanities: what fell vpon this prophane wretch, hauing a quarrell against one whom he met in a streete in London, and would haue stabd him: But the partie perceiuing his villany preuented him with catching his hand, and turning his owne dagger into his braines, and so blaspheming and cursing, he yeelded vp his stinking breath: marke this yee Players, that liue by making fooles laugh at sinne and wickednesse.'

[6] *Athenae Oxonienses* (1691), article on Thomas Newton, ed. 1815, vol. ii. column 9:

'But in the end, so it was, that this Marlo giving too large a swing to his own wit, and suffering his lust to have the full reins, fell to that outrage and extremity, as Jodelle a French tragical poet did, (being an epicure and an atheist,) that he denied God and his Son Christ, and not only in word blasphemed the Trinity, but also (as it was credibly* [*See in Tho. Beard's *Theatre of God's Judgments*, lib. 1. chap. 23.] reported) wrote divers discourses against it, affirming our Saviour to be a deceiver, and Moses to be a conjurer: The holy *Bible* also to contain only vain and idle stories, and all religion but a device of policy. But see the end of this person, which was noted by all, especially the precisians. For so it fell out, that he being deeply in love with a certain woman, had for his rival a bawdy serving-man, one rather fit to be a pimp, than an ingenious amoretto as Marlo conceived himself to be. Whereupon Marlo taking it to be an high affront, rush'd in

William Vaughan's *Golden Grove* (1600) shows, apparently, more actual knowledge of Marlowe's fate, but betrays a Puritanical bias no less strong than that of Beard:

Not inferiour to these was one Christopher Marlow by profession a playmaker, who, as it is reported, about 7. yeeres a-goe[7] wrote a booke against the Trinitie: but see the effects of Gods iustice; it so hapned, that at Detford, a little village about three miles distant from London, as he meant to stab with his ponyard one named Ingram, that had inuited him thither to a feast, and was then playing at tables, he quickly perceyuing it, so auoyded the thrust, that withall drawing out his dagger for his defence, hee stabd this Marlow into the eye, in such sort, that his braines comming out at the daggers point, hee shortlie after dyed. Thus did God, the true executioner of diuine iustice, worke the ende of impious Atheists.

Finally, in the second part of *The Return from Parnassus* (1601?) we find an echo of the Puritan note, derived probably from Beard, Meres, or Vaughan, in the trite coupling of artistic genius and hellish immorality:—

> *Marlowe* was happy in his buskind muse,
> Alas vnhappy in his life and end.
> Pitty it is that wit so ill should dwell,
> Wit lent from heauen, but vices sent from hell.
> *Ing.* Our Theatre hath lost, *Pluto* hath got,
> A Tragick penman for a driery plot.[8]

In a degree unusual even among university graduates Marlowe seems to have had a reputation for learning, and for a certain aloofness which might be ascribed, as one desired, to dignity or to pride. 'Great folly were it in me,' says the printer of *Tamburlaine* (1590), 'to commend vnto your wisedomes, either the eloquence of the Author that writ them, or the worthiness of the matter

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upon, to stab, him, with his dagger: But the serving-man being very quick, so avoided the stroke, that withal catching hold of Marlo's wrist, he stab'd his own dagger into his own head, in such sort, that notwithstanding all the means of surgery that could be wrought, he shortly after died of his wound, before the year 1593.'

[7] The second edition, dated 1608, says '14. yeres a-goe'. The passage quoted occurs in both editions on signatures C 4 verso and C 5.

[8] Dyce thinks the lines of this writer, 'whom no one will suspect of fanaticism,' a serious arraignment of the poet's character. There seems, however, no reason to suspect this Cambridge undergraduate of any independent knowledge of Marlowe's life in London. The wording of this allusion to Marlowe's end seems borrowed from Peele's in *The Honour of the Garter* (1593). Cf. below, p. 358.

itselfe; I therefore leaue vnto your learned censures, both the one and the other.' Chettle, whose humbler path had not crossed Marlowe's, and who feels bourgeois horror at the heretical notions ascribed to him, yet reverences his learning and recognizes that he is hardly one to be slightingly spoken of. The ceremonious epithet 'Gentleman' seems seldom to have been forgotten when he was named; and his contemporaries appear never to have remembered that he was a cobbler's son.[9]

His known acquaintances were men of worth and station, if of advanced ideas. Kyd credits him with no worse associates than Harriot, Warner, Royden, 'and some stationers in Paules Churchyard.' His familiarity with Raleigh is well established; his intimacy with Sir Thomas Walsingham even better. The words which Blount, one of the 'stationers in Paul's Churchyard,' uses of Marlowe in dedicating *Hero and Leander* (1598) to Walsingham manifest that 'the parts of reckoning and worth' which Marlowe's friends had found in him were still unashamedly avowed five years after his death.

If we discount Kyd's words, there is nothing to indicate on the part of the poets and publishers who were Marlowe's associates a sense that either his life or his death required apology. Concerning the manner of his death, his acquaintances maintain a reticence which is baffling to the biographer, but which is hardly compatible with the idea that there was in it anything outrageously sordid or spectacular.[10] For Shakespeare Marlowe is 'Dead Shepherd,' for

[9] There seems no justification for Fleay's suggestion that Greene is thinking of Marlowe when he says in *Menaphon*: 'Whosoever descanted of that love told you a Canterbury tale; some prophetical fullmouth, that, as he were a Cobler's eldest son, would by the last tell where another's shoe wrings.' (Fleay, *Shakspere*, p. 99.)

[10] Commenting on the popularity of the contemporary murder play about the year 1600, Hartley Coleridge (Introduction to Massinger and Ford in The Old Dramatists ed., p. xii, note) remarked: 'The death of Marlow might seem a tempting subject to a dramatist of the Domestic school; but I have not seen or read of any previous to the short and recent attempt of Mr. Horne.' Dyce replies: 'Surely, it is no wonder that the dramatists of those days did not endeavour to give additional publicity to the melancholy and disgraceful fate of one who had been the most eminent among them.' It may well be doubted whether all the dramatists would have been governed by such a scruple if the actual facts had possessed a great melodramatic appeal.

Nashe 'poore deceassed Kit Marlow'; for Blount, the publisher of *Hero and Leander* (1598), he is 'our friend,' the beloved object of his eyes, 'the man that hath beene deare vnto vs,' the 'impression' or influence of whom 'liuing an after life in our memory, there putteth vs in mind of further obsequies due vnto the deceased.' Thorpe, dedicating the Lucan to Blount (1600), writes 'in the memory of that pure Elementall wit *Chr. Marlow.*'

The tributes which Marlowe received from his fellow poets have been many times quoted. They are notably sincere and generous. Peele alone, writing his *Honour of the Garter* within a few weeks of the Deptford tragedy, has a word about the pity of it:

> Unhappy in thy end,
> Marlowe, the Muses darling, for thy verse
> Fit to write passions for the souls below,
> If any wretched souls in passion speak.

The idea, I take it, is not that Marlowe has gone to Christian hell, but that in the next world his dark genius would be able to render articulate the woes of Pluto's wretched souls. He is fit to write 'passions' for Tantalus and Sisyphus such as he has written for Faustus and Barabas.

Otherwise there is no sadness of farewell, but commendation unmarred by suggestion of reproach. Henry Petowe says (1598):

> Marlo, late mortall, now fram'd all diuine,
> What soule more happy then that soule of thine?
> Liue still in heauen thy soule, thy fame on earth.
>
> . . . .
>
> But Marlo, still-admired Marlo's gon
> To liue with beautie in Elyzium;
> Immortall beautie, who desires to heare
> His sacred poesies, sweete in euery eare:
> Marlo must frame to Orpheus melodie
> Himnes all diuine to make heauen harmonie;
> There euer liue the prince of poetrie,
> Liue with the liuing in eternitie . . .

So Chapman writes (*Hero and Leander,* 3rd Sestiad, 183 ff.):

> Then thou most strangely-intellectuall fire,
> That proper to my soule hast power t' inspire
> Her burning faculties, and with the wings
> Of thy vnspheared flame visitst the springs
> Of spirits immortall; Now (as swift as Time
> Doth follow Motion) finde th' eternall Clime

Of his free soule, whose liuing subiect stood
Vp to the chin in the Pyerean flood,
And drunke to me halfe this Musean storie,
Inscribing it to deathles Memorie:
Confer with it, and make my pledge as deepe,
That neithers draught be consecrate to sleepe.
Tell it how much his late desires I tender,
(If yet it know not) and to light surrender
My soules darke ofspring . . .

Nashe in 1599 (*Lenten Stuff*) speaks of 'Hero and Leander, of whom diuine Musaeus sung, and a diuiner Muse than him, Kit Marlowe.'[11] Drayton's tribute is perhaps the most adequate of all:

Neat Marlowe bathed in the Thespian Springs,
Had in him those braue translunary things
That your first poets had; his raptures were
All air and fire, which made his verses clear,
For that fine madness still he did retain,
Which rightly should possess a poets brain.[12]

Jonson's laconic phrase, 'Marlowe's mighty line' (1623), is characteristically impersonal; but there is evidence enough that long after his death the poet's memory retained associations not ungenial. Halliwell-Phillips cited an allusion to 'kynde Kit Marloe' from a manuscript poem: 'The Newe Metamorphosis, or

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[11] McKerrow's ed., iii. 195. Nashe's references to Marlowe are all friendly, though one of those in *Lenten Stuff* is jocular: 'At that she became a franticke Bacchanal outright, & made no more bones but sprāg after him, and so resignd vp her Priesthood, and left worke for *Musaeus* and *Kit Marlowe*.' (McKerrow iii. 198) In *Have with you to Saffron Walden* (1596), Nashe asserts (*ibid.*, iii. 131): 'I neuer abusd *Marloe, Greene, Chettle* in my life, nor anie of my frends that vsde me like a frend; which both *Marloe* and *Greene* (if they were aliue) vnder their hands would testifie.' In the same work (p. 85) Nashe reports Marlowe's judgment of Gabriel Harvey's brother Richard: 'This is that *Dick* of whom *Kit Marloe* was wont to say that he was an asse, good for nothing but to preach of the Iron Age.' He reprehends, on the other hand, Gabriel's vindictiveness: 'How he hath handled *Greene* and *Marloe* since their deaths, those that read his Bookes may iudge' (*ibid.*, p. 132); 'Maister *Lillie,* poore deceassed *Kit Marlowe,* reuerent Doctor *Perne* . . . in the same worke he hath most notoriously & vilely dealt with' (*Christ's Tears*, etc. 2nd ed., 1594, ii. 180, 181). Dr. McKerrow rightly points out that there is no reason for taking the attack upon 'idiote art-masters' in the preface to *Menaphon* as a gibe at Marlowe, though it may be inferred that Nashe was here temporarily influenced by Greene's pique against the Marlovian blank verse movement.

[12] *To Henry Reynolds, Esquire, Of Poets and Poesie,* 1627, ll. 105-110.

a Feaste of Fancie, or Poeticall Legendes, written by J. M. Gent. 1600.'[13] Dekker, at the end of *A Knight's Conjuring* (1607) gives a pleasant picture of lately deceased poets amusing themselves in the Elysian Fields, where '*Marlow*, *Greene*, and *Peele* had got vnder the shades of a large *vyne*, laughing to see *Nash* (that was but newly come to their Colledge,) still haunted with the sharpe and *Satyricall spirit* that followed him here vpon *earth*.'[14]

A digression on poets in Thomas Heywood's *Hierarchie of the Blessed Angels* (1635, lib. iv., p. 206) remarks:

> Our moderne Poets to that passe are driuen,
> Those names are curtal'd which they first had giuen;
> And, as we wisht to haue their memories drown'd,
> We scarcely can afford them halfe their sound.

Greene is instanced, and then 'Christ. Marlo':

> *Marlo*, renown'd for his rare art and wit,
> Could ne're attaine beyond the name of *Kit;*
> Although his *Hero* and *Leander* did
> Merit addition rather.

Heywood then mentions Kyd, Watson, Nashe, Beaumont, Shakespeare, Jonson, Fletcher and Webster, Dekker, May and Middleton, and Ford, and concludes:

> Nor speake I this, that any here exprest,
> Should thinke themselues lesse worthy than the rest,
> Whose names haue their full syllable and sound;
> Or that *Franck, Kit*, or *Iacke*, are the least wound
> Vnto their fame and merit. I for my part
> (Thinke others what they please) accept that heart
> Which courts my loue in most familiar phrase;
> And that it takes not from my paines or praise.
> If any one to me so bluntly com,
> I hold he loues me best that calls me *Tom*.

It was as the author of *Hero and Leander* and of the *Passionate Shepherd* that Marlowe enjoyed the highest personal reputation in the period immediately following his death. Shakespeare's allusion in *As You Like It* marks him distinctly as the author of

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[13] J. O. Halliwell, *The Life of William Shakespeare*, 1848, p. 191. The poem has been conjecturally assigned to John Marston.

[14] This passage was evidently written just before publication, since it is not found in Dekker's *News from Hell* (1606), of which *A Knight's Conjuring* is a revision.

these two works.[15] In the *Merry Wives of Windsor* (III. i.) Sir Hugh Evans sings the song. It drew forth other replies than that ascribed to Raleigh;[16] and as late as Walton's time (1653), when Marlowe's plays and the paganism of *Hero and Leander* were objects of equal scandal, it was still keeping the poet's memory fragrant.[17]

Even before the appearance of the first known edition in 1598, *Hero and Leander* seems to be referred to as Marlowe's most characteristic work. Thus Thomas Edwards (L'Envoy to *Narcissus,* 1595) deplores the deaths of Thomas Watson (d. 1592) and Marlowe under the names of their favorite heroes:

> *Amintas* and *Leander's* gone,
> Oh deere sonnes of stately kings,
> Blessed be your nimble throats
> That so amorously could sing.

Meres introduces a conventional reference to the poem,[18] and

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[15] 'Dead *Shepherd,* now I find thy saw of might,
"Who ever lov'd that lov'd not at first sight?"' (III. v. 81 f.)

'This is the only reference Shakespeare made to any author of his time. The only other contemporaries he mentioned were Queen Elizabeth, Lord Southampton, Lord Essex, and, indirectly, King James.' Henrietta C. Bartlett, *Mr. William Shakespeare: Original and Early Editions,* etc., 1922, p. 115.

[16] Cf. Roxburghe Ballads I. 205; *The Amorose Songes, Sonets, and Elegies* of Alexander Craige (1606), 'Alexis to Lesbia,' Hunterian Club ed., 1873, p. 151; Donne, *The Bait;* Herrick, *To Phillis to love and live with him.*

Dyce quotes two allusions from Nicholas Breton:—'At the least you shall heare the old song that you were wont to like well of, sung by the blacke browes with the cherrie-cheeke, vnder the side of the pide cow, *Come liue with me and be my loue'* (*A Poste with a Packet of Mad Letters*);

'Why, how now, doe you take me for a woman, that you come vpon me with a ballad of *Come liue with me and be my loue?'* (*Choice, Chance, and Change,* &c., 1606, p. 3)

[17] 'Her voice was good, and the ditty fitted for it; it was that smooth song which was made by Kit Marlow, now at least fifty years ago; and the milk-maid's mother sung an answer to it, which was made by Sir Walter Raleigh, in his younger days. They were old-fashioned poetry, but choicely good; I think much better than the strong lines that are now in fashion in this critical age.' (*The Complete Angler,* Chapter iv.)

[18] 'As Musaeus, who wrote the loue of *Hero* and *Leander,* had two excellent schollers, *Thamaras* & *Hercules:* so hath he in England two excellent Poets, imitators of him in the same argument and subject, *Christopher Marlow,* and *George Chapman.'* (*Palladis Tamia,* 1598.)

Raleigh and Drayton others which are less conventional.[19] Shakespeare, besides his direct quotation in *As You Like It*,[20] perhaps alludes to Marlowe's Leander in *The Two Gentlemen of Verona* (I. i. 20 ff.; III. i. 127 ff.), *Much Ado about Nothing* (V. ii. 30 ff.), *A Midsummer Night's Dream* (V. i. 199 ff.), and *As You Like It* (IV. i. 103 ff.) The anthology, *England's Parnassus* (1600) quotes about 140 lines from Marlowe's portion of the poem, and Bodenham's *Belvedere,* in the same year, cites many more.[21] In *Every Man in his Humour* (IV. i) Jonson bears witness to the surpassing popularity of Marlowe's lines with one type of contemporary society, the plagiarizing poetaster;[22] while Middleton, coupling *Hero and Leander* with *Venus and Adonis,* notes its appeal with another (*A Mad World, My Masters,* 1608, I. ii):

> I have conveyed away all her wanton pamphlets; as *Hero and Leander, Venus and Adonis;* O, two luscious marrow-bone pies for a young married wife!

Richard Carew, on the *Excellencies of the English Tongue* (ed. 1602, p. 13), similarly pairs the poems of Shakespeare and Marlowe, but with more respect:

> Would you read Catullus? Take Shakespeare and Marloe's fragment; that is the Venus & Adonis or Lucrece of the one and the Hero and Leander of the other.

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[19] 'On Sestus' shore, Leander's late resort,
Hero hath left no lamp to guide her love.
Thou lookest for light in vain, and storms arise;
She sleeps thy death, that erst thy danger sighed.' (*Cynthia*, bk. xxi.)

Compare Drayton's *Heroical Epistles* (1598), Mary to Charles Brandon:

'Here is no Bedlam Nurse, to pout nor lour,
When wantoning, we revel in my Towre,
Nor need I top my Turret with a Light,
To guide thee to me, as thou swim'st by Night.'

[20] Chapman himself quoted the line, 'Whoever loved that loved not at first sight?'—inaccurately and without acknowledgment—near the end of his *Blind Beggar of Alexandria* (1598). Heywood gives it correctly as 'the poet's excellent saying' in *The Captives* (Judson's ed., II. ii. 140).

[21] Charles Crawford (*Englische Studien* 43. 206) identifies fifty quotations from Marlowe in *Belvedere*, of which forty-three are from *Hero and Leander* and seven from *Edward II.*

[22] Master Matthew misquotes eight lines of the first Sestiad (199-204, 221 f.). Lines 199-204 (the opening of Leander's first speech to Hero) are again misquoted, with ludicrous intention, in Act I of *The Fleire* by Edward Sharpham (1607: ed. H. Nibbe, *Materialien*, 1912, p. 10, ll. 195 ff.).

The Rawlinson MS. version of Edmund Bolton's *Hypercritica* (*ca.* 1610?) mentions, among the books 'out of which wee gather the most warrantable English,' 'Marlowe his excellent fragment of Hero and Leander.' The version printed in 1722 omits both Marlowe and Shakespeare from the list (cf. J. Haslewood, *Ancient Critical Essays*, 1815, vol. ii, p. 246 f.).

The continuations by Petowe and Chapman are of course tributes to the effect of the original poem in 1598. Even the admired Chapman gained fame from the fact that he finished Marlowe's work: at least nine editions, between 1598 and 1637, note on the title-page that the poem was 'Begun by Christopher Marloe, and finished by George Chapman.' Chettle, in *England's Mourning Garment* (1603), thus speaks of the continuator:

> Neither doth Corin, full of worth and wit,
> That finished dead Musaeus' gracious song,
> With grace as great, and words and verse as fit,
> Chide meager death for doing virtue wrong.

In 'dead Musaeus' there is a double reference to the ancient Greek and to Marlowe. Chapman himself, in addressing 'to the Common Reader' his actual translation of the Greek poem (published 1616), says:

> When you see *Leander* and *Hero*, the subjects of this Pamphlet, I persuade myself your prejudice will increase to the contempt of it; either headlong presupposing it all one, or at no part matchable, with that partly excellent Poem of Maister Marloe's.

The learned Burton cites *Hero and Leander* frequently in the third part of the *Anatomy of Melancholy* (1621),[23] and the flippant Water-Poet, Taylor, sings it as he sculls:

> 'It chanc'd one evening, on a reedy bank,
> The Muses sat together in a rank:
> Whilst in my boat I did by water wander,
> Repeating lines of Hero and Leander.' (Taylor's *Motto*.)

A puzzled lover in John Cooke's comedy, *Greene's Tu Quoque, or The City Gallant* (1614),[24] turns to *Hero and Leander* for inspiration:

> There's no good to be done by praying for her,
> I see that; I must plunge into a passion:
> Now for a piece of Hero and Leander;

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[23] Ed. 1652, pp. 457, 458, 464, 468, etc.
[24] Hazlitt-Dodsley xi. 250 f.

'Twere excellent, and (praise be to my memory),
It has reach'd half a dozen lines for the purpose:
Well she shall have them—

Whereupon he recites, quite accurately, ten lines from Marlowe's discussion of virginity (I. 255-264).

In the fifth act of *Bartholomew Fair,* Jonson parodies Marlowe in the puppet-play of Lanthorn Leatherhead: 'The ancient modern history of Hero and Leander, otherwise called the Touchstone of true Love.' The dialogue between Cokes and Leatherhead implies no low opinion of the original work:

Cokes. But do you play it according to the printed book? I have read that.
Leatherhead. By no means, sir.
Cokes. No! how then?
Leatherhead. A better way, sir; that is too learned and poetical for our audience: what do they know what *Hellespont* is, *guilty of true love's blood?* or what *Abydos* is? or *the other, Sestos hight?*
Cokes. Thou art in the right; I do not know myself.

A striking statement of Jonson's personal judgment of Marlowe's *Hero and Leander,* and testimony to the poem's continued repute in the Commonwealth period, are found in R. C.'s preface to the posthumous *Chast and Lost Lovers* of William Bosworth (1651):[25]

The strength of his fancy, and the shadowing of it in words he [*i.e.*, Bosworth] taketh from Mr. *Marlow* in his *Hero* and *Leander,* whose mighty lines Mr. *Benjamin Iohnson* (a man sensible enough of his own abilities) was often heard to say, that they were Examples fitter for admiration than for parallel, you shall find our Author everywhere in this imitation. This the one [i.e., Bosworth].

Some say fair Cupid unto her inclin'd,
Mourn'd as he went, and thinking on her pin'd.

And in another place,

And as she went, casting her eyes aside,
Many admiring at her beauty dy'd.

This the other [*i.e.*, Marlowe],

And mighty Princes of her love deny'd,
Pin'd as they went, & thinking on her dy'd. [Cf. HL, I. 129f.]

You shall finde also how studious he is to follow him in those many quick and short sentences at the close of his fancy, with which he everywhere doth adorn his writings.

Bosworth's indebtedness to *Hero and Leander* is in fact very great. Richard Brome's *Mad Couple Well Matched,* first printed in

[25] Reprinted in Saintsbury's *Caroline Poets,* vol. ii.

1653,[26] alludes to *Hero and Leander* as still the *ne plus ultra* of amatory verse. In the second scene of the play, Wat cries: 'Had not this horne-head come, we had writ lines together should have put down Hero and Leander.' Another late play, *The Antiquary* (1641) by Shakerley Marmion, quotes two lines of Marlowe's poem (I. 219, 220).

'And then, I hope,' says Mocinigo to Lucretia, 'although I am base,

> Base in respect of you divine and pure,
> Dutiful service may your love procure.'

To which Lorenzo remarks: 'How now, Signor! What, love and poetry, have they two found you out? Nay, then you must conquer.'[27]

The two works of Marlowe which made the greatest stir in London were probably *Hero and Leander* and *Tamburlaine*. The marked difference in what the success of the two contributed to the poet's reputation is truly indicated in Heywood's 'Cockpit' prologue to the *Jew of Malta* (1633):[28] in *Hero and Leander* Marlowe did indeed gain a lasting memory; in *Tamburlaine* the laurels were gathered rather by Alleyn, the actor. References to *Tamburlaine* previous to the closing of the theatres are almost innumerable; yet so far are they from evidencing the personal prestige of the author that none appears to be extant which proves with absolute certainty that the speaker knew who wrote the play. It was as acted drama rather than as poetry that *Tamburlaine* was most frequently alluded to.[29] Plays directly imitative are numerous: Greene's *Alphonsus of Arragon*, *The First Part of Selimus*,

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[26] The date of composition is apparently *ca.* 1636.

[27] Act V. Hazlitt-Dodsley xiii, p. 506.

[28] 'In *Hero* and *Leander*, one [Marlowe] did gaine
A lasting memorie; in *Tamberlaine*,
This *Jew*, with others many: th' other wan
The Attribute of peerelesse . . .'

The squinting punctuation, which is probably intentional, has been the subject of much discussion.

[29] The fact is worthy of note by those who regard Marlowe's genius as essentially undramatic. There is a possible gibe at the alleged unsaleableness of printed texts of *Tamburlaine* in Greene's Epistle to the Gentlemen Students, prefixed to his *Farewell to Follie* (1591; ed. Grosart ix. 230). Greene says, with reference to the favorable reception of his *Mourning Garment:* 'the Pedler founde them too deare for his packe, that he was faine to bargain

The Troublesome Reign of John, The Battle of Alcazar, and *The Wars of Cyrus* are perhaps the best examples of the contemporary effort to share by pure imitation in the scenic triumph of Tamburlaine.

The tremendous figure which Alleyn made when he played the title-rôle was long remembered. The *Black Book's* comparison (1604) of the spindle-shank spiders stalking over Nashe's head 'as if they had been conning of *Tamburlaine*' is pictorial enough.[30] Hall, speaking of the corruption of the Muses and the prevalence of bastard poetry (*Virgidemiarum* lib. i, sat. iii, 1597), pictures both the ranting actor and the intrusive clownage against which the printer of *Tamburlaine* protests:

> One higher pitch'd doth set his soaring thought
> On crowned kings that Fortune hath low brought:
> Or some vpreared, high-aspiring swaine
> As it might be the Turkish *Tamberlaine.*
> Then weeneth he his base drink-drowned spright,
> Rapt to the threefold loft of heauens hight,
> When he conceiues vpon his fained stage
> The stalking steps of his great personage,
> Graced with huf-cap termes, and thundring threats,
> That his poore hearers hayre quite vpright sets.
> Such soone, as some braue-minded hungry youth,
> Sees fitly frame to his wide-strained mouth,
> He vaunts his voyce vpon an hyred stage,
> With high-set steps, and princely carriage:
> Now soouping (*sic*) in side robes of Royalty,
> That erst did skrub in lowsie brokery.
> There if he can with termes Italianate,
> Big-sounding sentences, and words of state,
> Faire patch me vp his pure *Iambick* verse,
> He rauishes the gazing Scaffolders:
> Then certes was the famous *Corduban*
> Neuer but halfe so high *Tragedian.*
> Now, least such frightfull showes of Fortunes fall,

for the life of Tamliuclin (*sic*) to wrappe vp his sweete powders in those vnsauorie papers.' It was, however, far from true that editions of *Tamburlaine* sold ill. A direct hit at Marlowe is found in Greene's *Menaphon* (1589: Grosart vi. 84): 'I read that mighty Tamberlaine, after his wife Zenocrate (the worlds fair eye) past out of the Theatre of this mortall life, he chose stigmaticall trulls to please his humorous fancy.' (Compare the second part of Marlowe's play, l. 2570: 'Now, bright Zenocrate, the worlds faire eie.')

[30] Bullen, Works of Middleton, vol. viii, p. 25.

And bloody Tyrants rage, should chance appall
The dead stroke audience, mids the silent rout
Comes leaping in a selfe-misformed lout,
And laughes, and grins, and frames his Mimik face,
And iustles straight into the princes place.
Then doth the *Theatre Eccho* all a loud,
With gladsome noyse of that applauding croud.
A goodly *hock-pock;* when vile Russetings,
Are match't with monarchs, & with mighty kings.
A goodly grace to sober *Tragick Muse*,
When each base clown, his clumbsie fist doth bruise,
And show his teeth in double rotten row,
For laughter at his selfe-resembled show.

'The generall welcomes Tamburlain receiu'd,
When he arriued last vpon our stage'

are specifically noted in the prologue to Marlowe's second part, and also in the prologue to *The Troublesome Reign of John* (1591).

Samuel Rowlands, in *The Life and Death of John Leyden* (1605),[31] summarizes the Scythian conqueror's career in lines evidently reminiscent of the play:

Haue you not heard that *Scythian Tamburlaine*
Was earst a Sheepheard ere he play'd the King?
First ouer Cattell hee began his raigne,
Then Countries in subiection hee did bring:
And Fortunes fauours so mayntain'd his side,
Kings were his Coach-horse, when he pleas'd to ride.

Bajazet's overthrow is comprehensively reviewed in the first scene of Dekker's *Old Fortunatus* (1600):

Poor Bajazet, old Turkish Emperor,
And once the greatest monarch in the East;
Fortune herself is sad to view thy fall,
And grieves to see thee glad to lick up crumbs
At the proud feet of that great Scythian swain,
Fortune's best minion, warlike Tamburlaine:
Yet must thou in a cage of iron be drawn
In triumph at his heels, and there in grief
Dash out thy brains.

Similar retrospects occur in *Selimus* (1594):

For Fortune never shew'd herself so cross
To any prince as to poor Bajazet.

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[31] *Hell's Broke Loose,* Grosart's ed., vol. i. p. 34.

> That woeful emperor first of my name,
> Whom the Tartarians locked in a cage
> To be a spectacle to all the world,
> Was ten times happier than I am.
> For Tamberlaine the scourge of nations,
> Was he that pull'd him from his kingdom so;
> But mine own sons expel me from the thron;[32]

and in Lord Stirling's *Doomsday* (1637):

> And Tamberlaine, the terrour of that age,
> On lightning Baiazet did thundering light,
> Tam'd for a foot-stoole in an iron cage.[33]

Vaguer, but sufficiently obvious, allusions to Bajazet and Tamburlaine are found in Heywood's *Golden Age* (1611),[34] Massinger's *Believe as You List* (1631),[35] and Habington's *Queen of Arragon* (1640).[36]

Most often, of course, the allusions to Alleyn's triumphs in *Tamburlaine* are jocose in tone. In the fifth act of *Histriomastix* (*ca.* 1598), soldiers command a captive player: 'Look up and play the *Tamburlaine*, you rogue you.' Drayton says in the Ballad of *Dowsabell* (1593):

> In fauour this same shepheards swayne
> Was like the bedlam Tamburlayne,
> Which helde prowd kings in awe.

Jonson parodies the doffing of Tamburlaine's peasant dress (l. 237) in *The Case is Altered.*[37] In the *Discoveries,* he speaks of 'the Tamerlanes and Tamar-Chams of the late age' as symbols of

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[32] Temple ed., ll. 1748 ff.

[33] Book iv, stanza 85.

[34] '*Titan.* Down, treacherous lord, and be our foot-pace now,
To ascend our high tribunal.' (III. i; Shakespeare Society ed., p. 48.)

[35] 'Then by the senators, whom I'll use as horses,
I will be drawn in a chariot . . .
Our enemy, led like a dog in a chain,
As I descend or reascend in state,
Shall serve for my footstool.' (III. iii; Mermaid ed., p. 424 f.)

[36] 'An emperor did serve
As footstool to the conqueror, and are we
Better assur'd of destiny?' (V. i; Hazlitt-Dodsley xiii, p. 396.)

[37] 'Lie there the weeds that I disdain to wear.' (I. i.)

barbarous taste, 'which had nothing in them but the scenical strutting, and furious vociferation, to warrant them to the ignorant gapers.' The use of Bajazet as footstool is travestied by Massinger in *The Maid of Honour* (II. ii):

> *Page* . . . Do it, and neatly;
> Or, having first tripped up thy heels, I'll make
> Thy back my footstool.
> *Sylli.* Tamburlaine in little!
> Am I turned Turk? What an office am I put to!

Dekker jokes at Tamburlaine's 'bloody flag' (ll. 1560 f.):

> What, dost thou summon a parlie my little drumsticke? tis too late; thou seest my red flag is hung out. (*Satiromastix* IV. ii. 38-40);[38]

and John Cooke has similar passages in *Greene's Tu Quoque* (1614).[39] William Rowley ridicules the soldan's mighty threats (ll. 1633 ff.) in *A New Wonder* (1632).[40] Even the truest and

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[38] Dekker's familiarity with the play is evidenced by many other passages; *e.g.*, *Satiromastix* (ed. Penniman, IV. iii. 210 f.), 'dost stampe mad Tamberlaine, dost stampe?'; (*ibid.* V. ii. 361 ff.), 'brag that your Vize-royes or Tributorie-Kings, haue done homage to you'; *Jests to Make You Merry* (Grosart, Non-Dram. Wks. ii. 349), 'It thundered and lightened all night, yet was it faire day the very next morning for furious *Tamberlaine,* who as you heard was cutting out 3. sorts of banners for his three sworne enemies'; *Seven Deadly Sins* (Grosart ii. 63), 'If therefore you, and *Fiue* companies greater then yours, should chuse a Colonel, to lead you against this mightie *Tamburlaine*, you are too weake to make him *Retire*, and if you should come to a battell, you would loose the day'; *News from Hell* (Grosart ii. 100), 'Nay, since my flag of defiance is hung forth, I will yeelde to no truce, but with such *Tamburlaine-like* furie match against this great Turke, and his legions, that Don Belzebub shall be ready to damne himselfe, and be horne-mad . . .'; *The Wonderful Year* (Grosart i. 110), 'Imagine then that all this while, Death (like a Spanish Leagar, or rather like stalking *Tamberlain*) hath pitcht his tents (being nothing but a heape of winding sheetes tackt together) in the sinfully-polluted Suburbes.'

[39] 'I will spread the Ensigne of my knighthood ouer the face of the Citty, which shall strike as great a terrour to my enemies, as euer *Tamberlaine* to the Turkes.' (Hazlitt-Dodsley xi. p. 186.) Also in the same play (p. 226): ''S foot, she plays the terrible tyrannising Tamberlane over him.'

[40] '*A noyse above at Cards.*
How now, how now, my roaring *Tamberlaine*
Take heede the Soldan comes.'

most terrible line of all the play (l. 4641) is mimicked in the first act of *The Battle of Alcazar* (1594):

> Tamburlaine, triumph not, for thou must die.[41]

In the Induction to the first part of Marston's *Antonio and Mellida* (1602) Tamburlaine is used as a mere byword for magniloquence.[42] The passage which was most remembered by the jesters was that in which Tamburlaine drives the 'pampered jades of Asia.' Pistol's misquotation (*2 Henry IV*, II. iv. 176 ff.) is the most famous:

> Shall pack-horses,
> And hollow pamper'd jades of Asia,
> Which cannot go but thirty miles a day,
> Compare with Caesars, and with Cannibals,
> And Trojan Greeks?

Lodge in *The Wounds of Civil War* (1594) causes Sylla similarly to enter in triumph, drawn by his captives. Tamburlaine was not the first thus to exult over the fallen; but Nashe probably has Marlowe's scene in mind when in his epistle dedicatory to *Strange News* (1592) he says of Harvey: 'now do I meane to present him and Shakerley to the Queens foole-taker for coatch-horses: for two that draw more equallie in one Oratoriall yoke of vaine-glorie there is not vnder heauen.'[43] Later in the same pamphlet there is a certain reference: 'Heere enters Argumentum a testimonio humano, like *Tamberlaine* drawne in a Chariot by foure Kings.' Quicksilver, the riotous apprentice in *Eastward Hoe* (1605), cries, 'Eastward Hoe: Holla ye pampered Iades of Asia.' The Fleire, by Edward Sharpham (1607; ed. Nibbe, p. 22), introduces the lines:

> Holla, holla ye pampred Iades of Asia,
> And can you draw but twentie miles a day?

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[41] 'Conuey Tamberlaine into our Affrike here,
To chastice and to menace lawfull kings,
Tamberlaine triumph not, for Thou must die.' (Malone Society ed., ll. 248-250.)

[42] After a pompous speech by Matzagente, Feliche says: 'Rampum scrampum, mount tuftie *Tamburlaine!* What rattling thunderclappe breakes from his lips?'

[43] Harvey's 'Gorgon sonnet,' appended to His *New Letter of Notable Contents* (1593), alludes to Shakerley as the Tamburlaine of Paul's. I do not think there is any personal allusion to Marlowe in this passage, such as Bullen and Grosart assumed.

The Coxcomb[44] and *The Sun's Darling*[45] repeat the phrase; and Taylor, the Water Poet, uses it to point his scorn of those who ride in coaches:

> Fulsome madams and new scurvy squires
> Should jolt the streets in pomp, at their desires;
> Like great triumphant *Tamburlaine* each day,
> Drawn with the pamper'd jades of *Belgia*.[46]

Marlowe's thrice-repeated line, 'And ride in triumph through Persepolis,' was of course well remembered. Ford's *Love's Sacrifice* (1633) puts it with ludicrous intention into the mouth of 'an old antic,' Mauruccio (Act II, sc. 1):

> Thus do we march to honour's haven of bliss,
> To ride in triumph through Persepolis.

The Soldan of Egypt's address at the opening of the fourth act of Part I, 'Awake, ye men of Memphis,' is repeated jocosely in the last line but one of the second act of Beaumont and Fletcher's

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[44] Act II, sc. i: 'weehee my pampered jade of *Asia*.' So in *Women Pleased* (IV. i.): 'Away, thou pamper'd jade of vanity.' Both these plays belong to the Beaumont-Fletcher canon.

[45] By Ford and Dekker (Act III. sc. ii.): 'I sweat like a pamper'd jade of *Asia*, and drop like a Cob-nut out of *Africa*.' A similar allusion is found in *The Variety*, a comedy by the first Duke of Newcastle (1649, Act V, sc. i, p. 72): 'the horses will runne as the devill were in the poope, for he drives like a Tamberlaine. *Simp(leton)*. Holla ye pamperd Jades.' So Day and Chettle's *Blind Beggar of Bednall-Green* (ed. Bang, l. 1660): 'I'll murther your Tamberlayn and his Coatch-horses.' This last play was written in 1600, but first printed in 1659.

[46] Taylor's *Works*, ed. 1630, signature Ll 3 (*A Thiefe*). So in *The World runnes on Wheeles* (*ibid.*, sig. Bbb 2): 'In a word, the Coach made mee thinke my selfe better then my betters that went on foot, and that I was but little inferiour to *Tamberlaine*, being iolted thus in state by those pampred Iades of *Belgia*.' R. Brathwaite jokes in the same strain in *A Strappado for the Diuell* (1615, ed. 1878, p. 159): *Upon a Poets Palfrey, lying in Lauander, for the discharge of his Prouender:*

> 'If I had liu'd when Fame-spred *Tamberlaine*
> Displaied his purple signalls in the East,
> *Hallow ye pamphred Iades*, had been in vaine,
> For mine's not pamphred, nor was ere at feast
> But once, which once's nere like to be againe,
> How methinks would hee haue scour'd the wheeles,
> Hauing braue *Tamberlaine* whipping ats heeles.'

Bonduca, and again, in altered form, in Act V, scene ii, of *Wit without Money*.

Lance. (*drunk*). Now could I fight, and fight with thee—
Valentine. With me, thou man of Memphis?[47]

Two very interesting allusions to *Tamburlaine* occur at the period of the outbreak of the civil wars. That in Sir John Suckling's play, *The Goblins* (ed. 1648, p. 46; ed. Hazlitt, vol. ii. p. 50) is hard to explain:

Enter *Poet* and *Theeves.*
De(vil). O, they have fetcht him off.
Po(et). Carer per so lo carer,
Or he that made the fairie Queene.
1 Th. No, none of these:
They are by themselves in some other place;
But here's he that writ *Tamberlane.*
Po. I beseech you bring me to him,
There's something in his Scene
Betwixt the Empresses a little high & clowdie,
I would resolve my selfe.
1 Th. You shall Sir.
Let me see—the Author of the *bold Beauchams,*
And *Englands Joy.*
Po. The last was a well writ piece, I assure you,
A Brittane I take it; and Shakespeares very way;
I desire to see the man.

A passage in Act III, sc. vi of *The Guardian* by Cowley, 'Acted before Prince Charles His Highness at Trinity-Colledg in Cambridge, upon the twelfth of March, 1641.' contains an important piece of information:

Bla(de). First, leave your raging, Sir: for though you should roar like *Tamerlin* at the Bull, 'twould do no good with me.
Tru(man). I *Tamerlin?* I scorn him, as much as you do, for your ears. I have an action of slander against you, Captain; you shall not miscal me at your pleasure . . .

[47] Among the lines of *Tamburlaine* echoed by contemporary writers are 369 ff., 635, 880, 1256, 1921 f., 1923, 1932, 2570, and 2598. Casual reference to 'martial' or 'mighty' Tamburlaine occurs in *George a Greene* (I. i. 43), *Alphonsus of Arragon* (IV. iii), *The Shoemaker's Holiday* (V. iv), the quarto version of *Every Man In his Humour* (III. ii), Randolph's *Hey for Honesty* (ed. Hazlitt, pp. 436, 438), Middleton's *Blurt Master Constable* (I. i).

Tru. Well, Sir! I'm not angry; but I'll not be call'd *Tamerlin* by any man.[48]

Doctor Faustus was hardly less frequently referred to than *Tamburlaine* by Marlowe's contemporaries, and it was almost equally imitated. Whether Greene's *Friar Bacon and Friar Bungay* was suggested by it is doubtful on grounds of chronology; but it seems clear that *Faustus* inspired important elements in the plot of *Old Fortunatus* (1600) by Dekker, *The Devil's Charter* (1607) by Barnes, *The Merry Devil of Edmonton,* and many other stage successes of the day. Imitation of noted passages abounds. The filchings from *Faustus* and *Tamburlaine* in *The Taming of a Shrew* (1594) are among the most glaring examples of Elizabethan plagiarism. Greene's *James IV* contains several apparent borrowings, as in the genealogy of Slipper (Act IV, sc. iii), and the lines:

> Mee thinkes I see her blushing steale a kisse,
> Vniting both your soules by such a sweete,
> And you, my King, suck Nectar from her lips.[49]

In the *Looking Glass for London* by Greene and Lodge parallels to lines 400 ff. and 1439 f. have been pointed out;[50] in the anonymous *Caesar's Revenge* (1607), parallels to lines 295, 1287, and 1342.[51]

The line, 'Was this the face that launched a thousand ships?' evidently stuck in Shakespeare's memory. He parodies it in *Troilus and Cressida,* II. ii. 81-83:

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[48] Bullen's statement, 'From Cowley's *Guardian* it appears that *Tamburlaine* was revived at the Bull about 1650,' is a slip. 1650 was the date of publication of the play, but the revival of *Tamburlaine* was evidently earlier than March, 1641, when the *Guardian* was acted, and consequently earlier than the closing of the theatres. The allusion to *Tamburlaine* is retained (in Act III, sc. vii) in the revised version of the *Guardian* published in 1661 as *Cutter of Coleman-Street.* Another disparaging reference occurs in Cowley's Ode, *Of Wit:*

> ''Tis not such *Lines* as almost crack the *Stage*
> When *Bajazet* begins to rage.
> Nor a tall *Metaphor* in the *Bombast way* . . .'

[49] Act IV, Scene v (ed. Collins, ll. 1728 ff.). Compare *Doctor Faustus,* ll. 1331 f.

[50] R. A. Law, *Modern Language Notes,* May, 1911.

[51] Charles Crawford, *Malone Society Collections,* I. 292 f.

Why, she (*i.e.,* Helen) is a pearl,
Whose price hath launch'd above a thousand ships,
And turn'd crown'd kings to merchants;

in *Richard II*, IV. i. 281-288:

Was this face the face
That every day under his household roof
Did keep ten thousand men? Was this the face
That like the sun did make beholders wink?
Was this the face that fac'd so many follies,
And was at last outfac'd by Bolingbroke?

and in *All's Well that Ends Well*, I. iii. 73-76:

Countess. Sirrah, tell my gentlewoman I would speak with her; Helen I mean.
Clown. Was this fair face the cause, quoth she,
Why the Grecians sacked Troy?[52]

Shakespeare introduces an allusion to the expanded version of *Faustus* in Bardolph's speech in *The Merry Wives of Windsor,* IV. v. 67 ff.:

for so soon as I came beyond Eton, they threw me off, from behind one of them, in a slough of mire; and set spurs and away, like three German devils, three Doctor Faustuses.[53]

It was natural that the play, particularly in the tawdry later version, should owe a part of its fame to its abundant horseplay. It was thus that Edward Phillips remembered it much later, when he said in his *Theatrum Poetarum* (1675): 'Of all that he (Mar-

[52] As late as 1620, Thomas May in *The Heir* offers another parody:

'I tell thee, sweet, a face not half so fair
As thine hath arm'd whole nations in the field,
And brought a thousand ships to Tenedos,
To sack lamented Troy.' (III. i., Hazlitt-Dodsley xi. p. 544)

[53] The reference is to the punishment of the knights by Faustus' devils in the 1616 version. When Pistol addresses Slender in the first scene with the words, 'How now, Mephistophilus!' the allusion is probably, as Creizenach says, to Slender's leanness, which suggests the 'lange, hagere Gestalt' of the stage Mephistophilis. The proverbial hideousness of Mephistophilis is indicated by a passage at the beginning of the third scene of Randolph's *Muses' Looking-Glass* (1638):—'*Enter a Deformed Fellow. Def. Fel.* Roscius, I hear you've a new play to-day.—*Ros.* We want you to play Mephistopheles. A pretty natural vizard.'

lowe) hath written to the Stage his *Dr. Faustus* hath made the greatest noise with its Devils and such like Tragical sport.'[54]

Samuel Rowlands in *The Knave of Clubs* (1609: ed. Grosart, ii. 29) relates a story which, if not true, is at least illustrative. A 'Gull' pays twenty pounds for

> A Deuill in a box,
> An artificiall flie of silke,
> (A deuill with a pox).

He and the knavish vendor are to make the devil rise by incantation.

> So both against the pointed day,
> Themselues for spirits arme,
> The Gull gets on a surplis,
> With a crosse vpon his breast,
> Like *Allen* playing *Faustus*,
> In that manner he was drest:
> And hauing all his furniture,
> He steps into the ring.

The result is that he is arrested by the constable and sent to Newgate.

Dekker remembers a striking feature of the stage action in his *Worke for Armourers* (1609: Grosart iv. 154): 'wilde fire flew from one to another, like squibs when Doctor *Faustus* goes to the diuell;' and again in *Newes from Hell* (1606: Grosart ii. 95): 'I swore by *Hellicon* (which he could neuer abide) that because tis out a fashion to bring a Diuell vpon the Stage, he should (spite of his spitting fire and Brimstone) be a Diuell in print.' John Melton, in *The Astrologaster, or the Figure-Caster*, (1620)[55] has a yet more definite allusion:

> Another will fore-tell of Lightning and Thunder that shall happen such a day, when there are no such Inflammations seene, except men goe to the *Fortune* in *Golding-Lane*, to see the Tragedie of Doctor *Faustus*. There in deede a man may behold shaggehayr'd Deuills runne roaring ouer the Stage with Squibs in their mouthes, while Drummers make Thunder in the Tyring-house, and the twelue-penny Hirelings make artificiall Lightning in their Heauens.

Ben Jonson's prologue to *Every Man in his Humour* (ed. 1616) alludes in more general language to *Faustus:*

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[54] See below, p. 387.

[55] Quoted by Tille, p. 145.

> Where neither *Chorus* wafts you ore the seas;
> Nor creaking throne comes downe, the boyes to please;
> Nor nimble squibbe is seene, to make afear'd
> The gentlewomen.[56]

A similar reference occurs in the prologue ('Spoken at the Globe') to Shirley's *Doubtful Heir*, which was licensed in 1640:

> Without impossibilities the plot:
> No clown, no squibs, no devil in 't.

It is clear that in Stuart times the excesses of actors and revampers had caused the public to forget the poetry in the play.

Uncanny occurrences are reported to have attended various performances. Middleton (?) in the *Black Book* (1604) alludes to one:

> Hee had a head of hayre like one of my Diuells in Doctor Faustus, when the olde theater crackt, and frighted the audience.[57]

Prynne in *Histrio-Mastix* (1633) tells how the actual devil once appeared among the feigned ones at a performance of the play:

> Not to relate the various tragicall ends of many, who in my remembrance at London, have beene slaine in Play-houses, or upon quarrels there commenced, . . . together with the *visible apparition of the Devill on the Stage at the Belsavage Play-house,*[58] *in Queene* Elizabeths *dayes, (to the great amazement both of the Actors and Spectators) whiles they were there pro-*

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[56] Compare the stage direction near the end of the 1616 version of *Faustus:* '*Musicke while the Throne descends.*' In the first line quoted Jonson probably has in mind both the Chorus in Shakespeare's *Henry V* and also the one which in the 1616 *Faustus* describes the hero's journeys.

[57] Bullen's Middleton, viii. p. 13. It is possible that the allusion is not to any actual occurrence at a performance of Marlowe's play, but to the tale of an optical illusion recorded in the eighth chapter of *The Second Report of Doctor John Faustus,* published in 1594. Here we read of a 'goodly stage' which appeared in the air above the heads of the spectators. A play was performed, and finally, 'When *Faustus* hauing long raged, of a soddaine howling lowde and tearing his haire, laid both his arms vpon his necke and leapt down headlong of the stage, the whole company immediatly vanishing, but the stage, with a most monstrous thundering crack followed *Faustus* hastely, the people verily thinking that they would haue fallen vppon them ran all away, and he was happiest that had the swiftest foote . . .' (Ed. A. E. Richards, p. 75.)

[58] The Bell Savage Inn on Ludgate Hill was one of the five regularly used for dramatic performances by the greater troupes of actors. Cf. Adams, *Shakespearean Playhouses,* p. 7.

phanely playing the History of Faustus (the truth of which I have heard from many now alive, who well remember it . . .'[59]

Allusions to Faustus and Mephistophilis are excessively common in literature previous to the Restoration, and even in later plays;[60] but they usually imply even less actual knowledge of Marlowe than do the references to *Tamburlaine*. One passage, indeed, in the second scene of the second act of *The Two Merry Milke-Maids* (1620),[61] shows a definite, though erroneous, recollection of certain scenes of *Doctor Faustus:*

Dor(igene). I hope he did not spend his time so ill
 In the Vniuersitie at *Wittemberg,*
 But he ha's learnt so much Philosophie,
 To tame those headstrong Passions.
Iul(ia). You may pray rather he ha's not spent his time
 As *Faustus* did, and many that are there,
 In Negromancie, so to performe the Taske
 You haue layd on him.
Dor. Alas poore VVench, do'st thou beleeue there can be such an Art?
Iul. VVhy, haue we it not recorded, *Faustus* did
 Fetch *Bruno's* Wife, Duchesse of *Saxonie,*
 In the dead time of Winter, Grapes she long'd for?
Dor. Such a Report there goes, but I hold fabulous.

Some lines in the poem of *The Time's Whistle,* by 'R. C. Gent.' (*ca.* 1614),[62] remember the tragic conception of Marlowe's *Faustus:*

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[59] *Histrio-Mastix,* Act. 6, sc. 19 (ed. 1633, fol. 556). The same story is reported from Germany. Meissner (*Die englischen Komoedianten in Oesterreich,* p. 91) cites the words of Grimmelshausen's *Simplicissimus:* 'Was agiret, spielet und sihet man doch lieber, als die Historiam des verruchten Ertzzauberers, Doctor Johannis Fausti, darum, dass ein Hauffen Teuffel darinnen allezeit eingeführet, und in allerhand abscheulichen Gebärden vorgestellet werden. Da doch bekannt, wie schon so manchermal bey solchen teufflischen Masqueradentänzen und Fausti-Comödien sich aus Verhängnüs Gottes auch rechte Teuffel unter denen so verstellten mit eingefunden und man nicht gewusst, wo dieser Vierde, oder Siebende, oder Zwölffte (wie in verschiedenen Begebenheiten geschehen, dass einer zuviel gewesen) herkommen.'

[60] See below, p. 383 ff. An allusion to 'the yrreverent doctor Fawstus, or some such grave patron of great play' in Sir John Harington's *Treatise on Playe* (*ca.* 1595; Tille p. 85) and two epigrams 'In Faustum' by Sir John Davies seem directed at some contemporary nicknamed Faustus.

[61] By J. C(umber?). Sig. F4^v and G1. The 1620 quarto is reproduced in the Tudor Facsimile Texts series.

[62] Ed. J. M. Cowper, Early English Text Society, vol. 48 (Tille, p. 135).

> O horrid act! O execrable evill!
> Another *Faustus*, haplesse hopelesse man,
> What wilt thou doe, when as that litle sand
> Of thy soone emptied houreglasse is spent?

Most frequently Faustus and Mephistophilis are but nicknames, one for any quack or conjuror, the other for a mischievous go-between or messenger. In Middleton's *Blurt, Master Constable* (1602) Truepenny, a servant, is asked by Hipolito: 'Sirrah *Mephostophiles*, did not you bring letters from my sister to the Frenchman?'[63] In the second scene of Dekker's *Satiromastix* (1602), Tucca says to Horace:

> So, thou must run of an errand for mee, Mephostophiles.
> *Hor.* To doe you pleasure, Captayne, I will, but whether?
> *Tuc.* To hell, thou knowst the way, to hell, my fire and brimstone, to hell.'

Sim Eyre in *The Shoemaker's Holiday* (1600) bids his wife 'avaunt, avaunt, avoid, Mephistophilus';[64] and Juniper in Jonson's *Case is Altered*[65] employs the same phrase: 'thou art not lunatic, art thou? an thou be'st, avoid, Mephostophilus!' In the *Alchemist* (IV. iv), Surly says of Subtle, 'he is the Faustus, That casteth figures and can conjure'; and in *A Tale of a Tub* (IV. v) Puppy wishes for 'a conjuring stick of doctor Faustus.'
Fletcher's *Wife for a Month* (V. ii) makes Tony say to the rascally servant, Podramo:

> Then he may pleasure the king at a dead pinch too,
> Without a Mephistophilus, such as thou art.

In the last scene of Massinger's *Picture* (1630), Sophia says to her husband:

> Why? you know
> How to resolve yourself what my intents are,
> By the help of Mephistophilus, and your picture.

In *The Young Admiral* (1633) by Shirley (IV. i), Flavia asks, 'Where is Mephistophilus?' and Pazzorello cries, 'No more devils, if you love me.'
The first scene of Glapthorne's *Wit in a Constable* (1639) contains an invective against the bookish youth who prefers to 'walke

[63] Act II, scene i.
[64] Act V, scene iv.
[65] Act II, scene iv (scene viii, l. 148 of Selin's ed.).

like *Faustus*. Or some high German conjurer, in a cap Fit for a Coster-monger.'

Faustus and Mephistophilis are lumped together in the last act of J. D.'s *Knave in Grain* (1640): 'Ile say, hee is more than a Cheater, and a Doctor *Faustus*, or *Mephostophilus* at least;'[66] and similarly in *The Cunning Lovers* (V. i) by Alexander Brome (1654): 'Sweet Conjurer, good *Mephastophilus*'—'No more, sweet Doctor Faustus, no more.'[67] Thomas Randolph was particularly fond of such allusions; *e. g.*, in *Aristippus* (1630)[68] ''Tis not your Mephistophilis . . . nor your good father-in-law Doctor Faustus'; and in *Hey for Honesty* (1651),[69] where the names of Faustus and Mephistophilis are broadcasted over two pages: 'I'll go to Dr. Faustus, true son and heir To Beelzebub'—'This Dr. Faustus, The Mephistopheles of his age'—'We fear not Dr. Faustus'—'Let Dr. Faustus do his worst'—'I am not so much afraid of Dr. Faustus.' In Act IV, scene vi of his *Amyntas* (1638) Randolph echoes Marlowe in more veritable fashion, as he puts in the mouth of his Amaryllis the words Faustus speaks to Mephistophilis (DF, l. 494):

Amar. My blood congeales
Within my quill, and I can write no more.[70]

The great contemporary popularity of *The Jew of Malta* and *The Massacre at Paris* is attested by Henslowe's records of performances; and their continued appeal in the seventeenth century by Heywood's revision of the one and Webster's (apparently) of the other. Though parodies and allusions are less frequent, Barabas can hardly have been a less familiar figure than Tamburlaine or Faustus. It would seem that the original triumph of the *Jew* moved Shakespeare to write *The Merchant of Venice*, and it is a likely hypothesis, I think, that Henslowe's revival of the *Jew* in 1601 gave him the first impulse to write another play of Mediterranean races and politics—*Othello, the Moor of Venice*.

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[66] So in Act IV of the same play: 'Thou art the very meere *Mephostophelus*, and I perswade my selfe thou hast new vampt thy wits.' (Tille, p. 182.)

[67] Tille, p. 193.

[68] Ed. Hazlitt, p. 11.

[69] *Ibid.*, p. 458, 459.

[70] *Ibid.*, p. 341.

The opening speech of Jonson's *Volpone* is influenced by the first speech of Barabas; and Act V, scene viii of the same play, where Mosca and Volpone bicker over the half of Volpone's estate, appears to be a reminiscence of Barabas before the Governor (ll. 267 ff.). The rich Jew of Malta became a stock type, and the phrase was employed almost proverbially by writers of the period.[71]

The reputation of *Edward II* on the stage appears to have been smaller, perhaps because Alleyn did not present a rôle; but the deep impression which the play made upon contemporary playwrights is evidenced by the copious borrowing of lines by the authors of *Arden of Feversham*, *Soliman and Perseda*, and *Edward I*.[72] Drayton's *Barons' Wars*, Shakespeare's *Richard II*, and the so-called *Tragedy of Woodstock* were certainly largely influenced by *Edward II*. The publication of editions as late as 1612 and 1622, moreover, shows that this play did not early lose its hold on the reading public, as *Tamburlaine* seems to have done; but it was most likely from the start caviare to the general.

The evidence of printed editions and of literary allusions shows that *Hero and Leander*, *The Passionate Shepherd*, *Doctor Faustus*, *Edward II*, and in less degree *The Jew of Malta*, continued to be read to the period of the civil wars; while *Tamburlaine*, *Faustus*, and the *Jew* remained favorites on the popular stage. The edition of *Faustus* in 1663 shows that a debased form of that play, with

[71] Harington, *Epigrams* (1592?):

'Was euer Iew of Malta or of Millain
Than this most damned Iew more Iewish villaine?'

Dekker, *The Deuils Answer to Pierce Pennylesse* (1606), ed. Grosart, ii. 142: 'Lies there a Boate readie (quoth my rich Iew of *Malta*) to take me in so soone as I call?'

Dekker, *Seven Deadly Sins*, Grosart, ii. 31: 'When it came to the eares of the *Sinfull Synagogue*, how the rich Iew of *London*, (*Barabbas Bankruptisme*) their brother, was receyued into the Citty, and what a lusty *Reueler* he was become . . .'

Rowley, *Search for Money* (1609): 'his visage (or vizard) like the artificiall Jewe of Maltaes nose.'

Cowley, *Cutter of Coleman Street* (*Guardian*, 1641), II. iii: 'But I'm the very *Jew of Malta*, if she did not use me since that worse than I'd use a rotten apple.'

[72] The verbal parallels with these plays, and also with Lodge's *Wounds of Civil War* are striking. The influence of Marlowe (particularly his *Dido* and *Edward II*) upon Richard Barnfield is treated by Charles Crawford (*Collectanea* I, 1 ff.).

contaminations from the *Jew*, was acted even later than the closing of the theatres in 1642.[73] To the evidence which Cowley's *Guardian* gives for a late revival of *Tamburlaine* at the Bull[74] should be added the statement of Edmund Gayton (*Festivous Notes on Don Quixote*, 1654) on the particular popularity of that play and *The Jew of Malta:*

> I have known, upon one of these festivals . . . where the players have been appointed, notwithstanding their bills to the contrary, to act what the major part of the company had a mind to; sometimes *Tamburlaine*, sometimes *Jugurth*, sometimes *The Jew of Malta*, and sometimes parts of all these . . .

Marlowe's plays were early carried to Germany by English acting companies; and two of them—*Doctor Faustus* and *The Jew of Malta*—enjoyed there a lasting vogue. The traveling diary of a merchant from Würtemberg is said to record the performance at Frankfort during the autumn fair of 1592 of several plays of the 'dort im Inselland gar berühmten Herrn Christopher Marlowe.'[75] The company was that of Robert Browne, which had left England the previous year, and the language was presumably English. A letter of the Archduchess Maria Magdalena of Graz notes the performance by English actors (under the leadership of John Green) on Sunday, February 10, 1608 of 'dockhtor Faustus' and on the Thursday following 'von dem Juden, die sy auch zu passau gehalten haben.'[76] The same company, still under

[73] See below, p. 385.

[74] See above, p. 372.

[75] Cf. J. Meissner, *Die englischen Komoedianten zur Zeit Shakespeares in Oesterreich*, p. 89 f.; and particularly Elisabeth Mentzel, *Geschichte der Schauspielkunst in Frankfurt am Main*. The chapter in the latter work on 'Die ersten Berufskomödianten in Frankfurt' notes that the repertory of the first English actors and the place in Frankfurt where they performed are not indicated in the extant documents. The author then continues (p. 23): 'Aber was hier unzulänglich ist, ergänzt eine Notiz aus dem Reisebüchlein eines "Würtenbergischen Kaufmanns," der einige Jahre früher eine Reise nach "dem Inselland" unternommen hatte und der englischen Sprache vollständig mächtig war. Hiernach wurden während seiner Aufenthaltes in der Herbstmesse 1592 von den "Englischen" in Frankfurt mehrere Stücke des "dort im Inselland gar berühmten Herrn Christopher Marlowe" und auch "das lustig Spill Gammer Gurtons Needle mit allerley kunstlich Verdrehungen auf das theatro gebracht."' The document cited appears now to be untraceable.

[76] The performance at Passau took place during the previous November. See Meissner, p. 76.

the management of Green, acted *Faustus* and the *Jew* at Dresden in 1626.[77] In 1651 Prague also saw performances of 'die Tragödie von dem Erzzauberer Doctor J. Faust.'

A curious contamination of Shakespeare's *Merchant of Venice* with traces of *The Jew of Malta* exists in a late seventeenth-century Austrian manuscript entitled 'Comoedia Genandt Dass Wohl Gesprochene Uhrtheil Eynes Weiblichen Studenten oder Der Jud von Venedig.'[78] In the main this is a corruption of Shakespeare's comedy, with elements possibly from the lost English play of *The French Doctor;*[79] but a reminiscence of Marlowe remains in the name of the Jew, 'Jud Barrabas, hernach Joseph,'[80] while a distinct allusion to *The Jew of Malta* occurs in the first scene: 'Man Weiss wass sie (*i. e.*, the Jews) neulich Zu Malta Vorgenohmen haben. Sie dürfften wohl dermahleins diesses gantzes Königreich den Türcken verrathen.' Meissner appears to be correct in identifying this comedy with one mentioned by the Archduchess Magdalena as acted on Shrove Monday, 1608, 'Von einem König von Cypern und einem Herzog von Venedig'; with a 'Teutsche Komedia des Jud von Venedig auss dem engeländischen', acted at Halle in 1611; with a 'Comödia von Josepho Juden von Venedigk', acted by Green's company at Dresden, July 13 and November 5, 1626; with the play 'Von dem König aus Cypern u. dem Fürsten aus Venetia', performed by the Dresden Court Company at Prague in 1651; and finally with the 'Josephus Juden von Venedig', which 'English Comedians' acted in Dresden in 1674. The date at which the existing text was put together can be fixed by an internal allusion as shortly after 1605.'[81]

[77] The Dresden entries read (Meissner, pp. 90, 93):

'Julius 7—Ist eine Tragödia von Dr. Faust gespielt worden.

Julius 31—Ist eine Tragödia von Barrabas Juden von Malta gespielt worden.

Augustus 29—Ist eine Tragödia von Barrabas Juden von Malta gespielt worden.'

[78] Printed in full by Meissner, pp. 131 ff. An abstract in English is given in the Furness Variorum edition of *The Merchant of Venice.*

[79] See Greg, *Henslowe's Diary*, ii. 170, 171.

[80] The latter part of the name possibly refers to Juan Miques, who became Josef Nassi.

[81] See Meissner, pp. 108 ff.

II. FROM THE CLOSING OF THE THEATRES TO THE APPEARANCE OF DODSLEY'S SELECT COLLECTION OF OLD PLAYS (1642-1744)

Marlowe was not one of the Elizabethans whose popularity survived the Elizabethan era. His 'translunary' genius was equally alien to Puritan and to Restoration taste. The allusions already cited show, indeed, that, as a dramatist at least, his reputation had shrunk to very small proportions before the death of James I. On the outbreak of the civil wars it fell into almost total eclipse. There was no edition of any of his works between 1642 and the appearance of the first Dodsley in 1744, except the spurious *Lust's Dominion* and the shabby 1663 perversion of *Doctor Faustus*.[82] The encyclopedic poem 'On the Time-Poets,'[83] published in 1656, speaks of Jonson, Fletcher, Beaumont, Shakespeare, Massinger, Chapman, Daborne, Sylvester, Quarles, May, Sandys, Digges, Daniel, Drayton, Wither, Browne, Shirley, Ford, Middleton, Heywood, Churchyard, Dekker, Basse, Brome, Chaucer, and Spenser; but has not a word to say of Marlowe. Fuller's *Worthies of England* (1662) is equally silent. Dryden never mentions him; nor does Downes, whose *Roscius Anglicanus* (1708) records the dramatic performances that took place between 1641 and 1660. The only evidence that Marlowe's influence was still alive in the Restoration age may be found in the apparent reminiscences of Mephistophilis in Milton's Satan; but even Milton does not anywhere refer specifically to Marlowe.

A very few casual allusions there are to the past popularity of the Marlowe plays. Those of Gayton and Cowley, belonging really to the period before the suppression of theatres, though repeated later, have been already quoted. Davenant says in his *Playhouse to be Let* (ca. 1663):

> There's an old tradition,
> That in the times of mighty "Tamburlaine,"

[82] Moseley's entry of 'a comedie called *The Maidens Holiday* by Christopher Marlow and John Day,' April 8, 1654, would indicate perhaps that Marlowe's name still carried some weight; as would the statement, 'Written by Christofer Marloe, Gent.' on Kirkman's two title-pages of *Lust's Dominion* (1657, 1661).

[83] In *Choyce Drollery, Songs, and Sonnets.* Reprinted by Halliwell in The Shakespeare Society's *Papers* iii. 172-174, 1847.

Of Conjuring "Faustus," and the "Beauchamps bold,"
You poets us'd to have the second day.[84]

An allusion in the fourth act of Shadwell's *Humourists* (1670) shows equally well that *Tamburlaine* had been relegated to the times of old tradition, and that reference to the humbling of Bajazeth, once so trite, now had the strangeness of novelty. Drybob says:

I have been beaten more severely, than ever *Turk* was by *Tamerlain;* which, by the way, is no ill Comparison: hah?

By the close of Charles II's reign even this little had been forgotten. When C. Saunders published in 1681 his unsuccessful play of '*Tamerlane the Great.* A Tragedy. As it is Acted by their Majesties Servants at the Theatre Royal,' he was able to speak as follows of certain condemnatory critics:

and the means they took, was to give out, that this was only an Old Play Transcrib'd. But I hope I may easily unload my self of that Calumny, when I shall testifie that I never heard of any Play on the same Subject, untill my own was Acted, neither have I since seen it, though it hath been told me, there is a Cock Pit Play, going under the name of the *Scythian Shepherd*, or *Tamberlain the Great,* which how good it is, any one may Judge by its obscurity, being a thing, not a Bookseller in *London*, or scarce the Players themselves, who Acted it formerly, cou'd call to Remembrance, so far, that I believe that whoever was the Author, he might e'en keep it to himself secure from invasion, or Plagiary; But let those who have Read it Convince themselves of their Errors, that this is no second Edition, but an entirely new Play. Moreover, utterly to overthrow this Objection, I must acquaint you that I drew the design of this Play, from a late Novell, call'd *Tamerlane* and *Asteria*, which I'm sure bears not half the Age of the Tragedy before mention'd and I am confident the Characters are quite different.

Saunders oversteps the literal truth when he says that the booksellers of the day were totally unacquainted with *Tamburlaine*, for the two parts are duly listed in the catalogues of 1656-1671;[85] but his own innocence of all knowledge of his predecessor is unquestionable, as is also that of Nicholas Rowe, whose more successful *Tamerlane* (1702) symbolized in its hero the magnanimity of William of Orange.[86]

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[84] The mention of the *Bold Beauchamps* indicates that Davenant remembered Suckling's allusion in *The Goblins* (*cf. ante*, p. 372).

[85] See Greg, *List of Masques, etc.*, Appendix ii, p. cx.

[86] Sir Sidney Lee (D. N. B.) thinks an indebtedness to Marlowe's *Tamburlaine* discernible in Sir Francis Fane's tragedy, *The Sacrifice* (1686). This is a work in very rococo style, but the relation seems dubious.

The 1663 quarto of *Doctor Faustus*, 'Printed with New Additions as it is now Acted. With several New Scenes,' bears the words 'Written by Ch. Mar.' and testifies to some remaining interest among the vulgar; but the text is terribly mutilated, and the additions conceived in a spirit of the rankest buffoonery. The most interesting thing about these additions is the brief digest of part of the plot of the *Jew of Malta*, reported in some thirty lines to the Sultan of Babylon (signature D2). The text here printed is what Pepys saw acted, May 26, 1662 (ed. Mynors Bright ii. p. 250):—'by water to my brother's, and thence to take my wife to the Redd Bull, where we saw Dr. Faustus, but so wretchedly and poorly done, that we were sick of it, and the worse because by a former resolution it is to be the last play we are to see till Michaelmas.'

The effect of this last of all the Marlowe quartos appears to have been nil, in so far as Marlowe's reputation is concerned. Allusions to Doctor Faustus and, more rarely, to Mephistophilis occur during the Commonwealth[87] and after the Restoration, but it is evident from them that Marlowe had been supplanted as the source of knowledge by chapbooks and puppet-shows. Usually Mephistophilis becomes simply 'the Devil,' and in course of time Faustus degenerates into 'Doctor Foster.'[88] Edmund Prestwich's poem, *An Ale-match*,[89] clearly has the chapbook narrative in mind. A tavern-keeper lends a group of tipplers

> A boy-like *Mephostophiles* to attend 'em
> Whom they keep in perpetuall motion, still
> Emploid either to empty, or to fill . . . .
> By this time they had made more Ale away
> Than would have serv'd *Faustus* to 's load of hay.

Other allusions are of the vaguest kind. A poem called 'Upon Lutestrings Cat-eaten' in the *Musarum Deliciae* of Sir John Mennis and James Smith (1656) mentions

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[87] Allusions found in plays printed during the Commonwealth period, but composed and acted earlier, have been quoted in the previous section.

[88] *Cf.* Defoe, *The History of the Devil*, Pt. II, ch. vii (ed. 1727, p. 286): 'No doubt the *Devil* and Dr. *Faustus* were very intimate; I should rob you of a very significant *Proverb, if I should so much as doubt it.

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* *As great as the Devil and Doctor* Faustus. Vulg. Dr. *Foster.*'

[89] In poems appended to his translation of Seneca's *Hippolytus* (1651). Quoted by Tille, p. 985 f.

> A thousand tricks, that may be taken
> From *Faustus, Lambe*, or *Frier-Bacon.*

Cowley carries over from *The Guardian* into *Cutter of Coleman-street* (1663) the cant name 'Mephistophilus' for a quick-moving spirit of mischief.'[90] Shadwell's Sir Positive At-all, near the close of Act II of *The Sullen Lovers* (1668), says that he will 'raise a Devil with Doctor *Faustus* himself, if he were alive.' An undated work by L. P., called *The Witch of the Woodlands, or the Coblers new Translation*,[91] has on the title-page the lines:

> Here Robin the Cobler, for his former evils
> Is punish'd bad as Faustus with his Devils.

Thomas Jordain's *Money is an Asse* (1668) has in the second act the humorous remark, 'Well—now *Faustus* calls his *Mephistophilis*.' And Pedanto, a schoolmaster in R. Wild's comedy, *The Benefice* (1689), defines a dialogue as 'a Discourse like that between Dr. *Faustus* and the *Devil*, or two or three men in a Pig-Market. That's a Dialogue.' (Tille, pp. 992, 994.)

A development quite in line with the Restoration attitude to *Faustus* is the work of William Mountford, posthumously printed in 1697: 'The Life and Death of Doctor Faustus, Made into a Farce. By Mr. Mountford. With the Humours of *Harlequin* and *Scaramouche*, As they were several times Acted by Mr. Lee and Mr. Jevon, at the Queens Theatre in *Dorset* Garden. Newly Revived, at the Theatre in *Lincolns Inn Fields*, With Songs and *Dances* between the Acts.'[92] Marlowe's name here disappears from the title-page, and only enough of his work remains to give a bizarre absurdity to the incrustations. About 150 lines of the original verse are retained in broken patches, and the scenes of the Deadly Sins, the Horsecourser, the Hostess and Carter, and Benvolio's revenge are re-worked; but over half the actual lines and the whole of the tone are Mountford's alone.

From this time Faustus lost all connection in the public mind with Marlowe. A series of harlequinades in imitation of Mount-

[90] 'How a Devil that little *Mephostophilus* got hither before me?' (III. xi.)

[91] The British Museum catalogue dates the book 1670 (?). Cf. Tille, p. 992.

[92] Mountford's text has been edited, with a valuable introduction, by O. Francke, Heilbronn, 1886. Genest (vol. i, p. 450 f.) dates the original production of the farce at Dorset Garden, *ca.* 1686.

ford were produced during the eighteenth century, notably in 1724 and the following years, when rival versions by Thurmond[93] and Rich played in opposition, and evoked the ridicule of Pope's *Dunciad* (1728, bk. iii. 307 ff.):

> To aid our cause, if Heav'n thou can'st not bend,
> Hell thou shalt move; for Faustus is our friend:
> Pluto with Cato thou for this shalt join . . . .[94]

The memory of Marlowe appears to have lingered after the Restoration only with the professional compilers of antiquarian knowledge, whose accounts are often fantastically inaccurate. The most adequate treatment he received at this time was at the hands of the inaccurate Edward Phillips (*Theatrum Poetarum*, 1675), who has been supposed to have got some of his criticisms from his uncle, Milton.[95] Phillips writes of Marlowe:

> *Christopher Marlow*, a kind of a second *Shakesphear* (whose contemporary he was) not only because like him he rose from an Actor to be a maker of Plays, though inferiour both in Fame and Merit; but also because in his begun Poem of *Hero* and *Leander*, he seems to have a resemblance of that clean and unsophisticated Wit, which is natural to that incomparable Poet; this Poem being left unfinished by *Marlow*, who in some riotous Fray came to an untimely and violent End, was thought worthy of the finishing Hand of *Chapman;* in the performance whereof nevertheless he fell short of the Spirit and Invention with which it was begun; of all that he hath written to the Stage his Dr. *Faustus* hath made the greatest noise with its Devils and such like Tragical sport, nor are his other 2 Tragedies to be forgotten, namely his *Edw.* the II. and *Massacre at Paris*, besides his *Jew of Malta* a Tragecomedie, and his Tragedy of *Dido*, in which he was joyned with *Nash*.

John Aubrey (1626-1697) says of Ben Jonson, on the alleged authority of Sir Edward Shirburne:—'He killed Mr. . . Marlow, the poet, on Bunhill, comeing from the Green-Curtain playhouse.—From Sir Edward Shirburn.'[96] Aubrey's adversary,

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[93] For the scenario of Thurmond's *Harlequin Dr. Faustus*, see A. Diebler, *Anglia* vii, 341-354 (1884): *Faust- und Wagnerpantomimen in England.*

[94] Pope's note on this passage runs:—'*Faustus, Pluto, &c.* Names of miserable Farces, which it was the custom to act at the end of the best Tragedies, to spoil the digestion of the audience.' He adds, of the two playhouses:—'they also rival'd each other in showing the burnings of hell-fire, in Dr. Faustus.'

[95] See, however, E. N. S. Thompson, 'Milton's Part in *Theatrum Poetarum*,' *Mod. Lang. Notes*, January, 1921.

[96] *Brief Lives*, set down between 1669 and 1696, ed. A. Clark, 1898, vol. ii. p. 13. 'The doating Aubrey, who implicitly swallows every idle story, and confounds every true one.' (Gifford.)

Anthony Wood, treats Marlowe incidentally in the course of his article on Thomas Newton, the reputed author of *Tamburlaine*. Wood takes over most of what Phillips says, with characteristic adaptation, but he makes an advance by denying Phillips' ascription of *Tamburlaine* to Newton, and then proceeds, in a passage which has been quoted earlier, to rewrite the story of Marlowe's life by the light of Beard, Meres, and his own imagination.[97]

Gerard Langbaine's *New Catalogue of English Plays* (1688) and his *Account of the English Dramatick Poets* (1691) illustrate the scanty and often fallacious ideas of Marlowe that survived. In the *Account*, which appeared in the same year as Wood's *Athenae*, Langbaine likewise rebukes Phillips for his error about *Tamburlaine*: 'I know not how Mr. Philips came to ascribe *Tamburlaine the Great* to this Author; for tho' Marloe's Name be not printed in the Title-page, yet both in Mr. Kirkman's and my former Catalogue printed 1680, his Name is prefix'd.'[98] Charles Gildon's amplification of Langbaine did nothing for Marlowe and little for any other author. Its title is the best thing about this book: 'The Lives and Characters of the English Dramatick Poets. Also an Exact Account of all the Plays that were ever yet Printed in the English Tongue . . . with Remarks and Observations on most of the said Plays. First begun by Mr. Langbain, improv'd and continued down to this Time, by a Careful Hand' (1699). The manuscript notes of the antiquaries, Thomas Coxeter (1689-1747) and William Oldys (1696-1761), show no advance in knowledge or sympathy. Oldys, writing in a copy of Langbaine (ed. 1691), thus purblindly sums up Marlowe: 'Christopher Marloe was born about the former part of Edwd. VI. Educated at Cambridge, afterwards an Actor and then a writer of plays.'

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[97] See above, p. 355, n. 6.

[98] Kirkman's second catalogue (1671) first marked the author of *Tamburlaine* as Marlowe. Langbaine's disgust at Phillips' obtuseness is a little naive, however, for neither he nor Kirkman stands high as an authority on Elizabethan authorship. It should be said in fairness, however, that Langbaine pointed out a number of the most interesting allusions to Marlowe.

III. FROM DODSLEY'S SELECT COLLECTION OF OLD PLAYS (1744) TO THE PRESENT

The history of the rediscovery of Marlowe may well be begun with the publication of *Edward II* in the original edition of Dodsley's *Old Plays* in 1744. This was the first genuine work of the poet to be printed for over a century; *i. e.*, since the 1637 edition of *Hero and Leander*.[99] The *Jew of Malta* was added in the second edition of Dodsley (1780). *Doctor Faustus* was published in C. W. Dilke's *Old English Plays* (1814) and the *Old Plays* of 1816; *Edward II* and *The Jew of Malta*[100] in The *Ancient British Drama* of 1810; *Hero and Leander* in Sir E. Brydges' *Restituta* (1815), Chapple's *Old English Poets* (1820), and Singer's *Select English Poets* (1821); *Dido* in Hurst, Robinson & Co.'s *Old English Drama* (1825). *Tamburlaine* had been printed, we are told, in 1818, under the editorship of James Broughton; but this work was not published.[101] In 1818, W. Oxberry, comedian and printer, brought out separate texts, with slender prefatory remarks and a few footnotes, of the *Jew of Malta, Edward the Second, Doctor Faustus, Lust's Dominion,* and *The Massacre at Paris*. To these he added in 1820 the two parts of *Tamburlaine*. In 1827 these were all bound together, along with an undated edition of *Dido*, in a single volume entitled *The Dramatic Works of Christopher Marlowe, With Prefatory Remarks, Notes, Critical and Explanatory*, by W. Oxberry, Comedian. Prefixed are two brief sets of 'Remarks' signed H. M. M(aitland?).

The first collected edition of Marlowe had, however, already appeared during the preceding year (1826) in three handsome,

[99] *Lust's Dominion* (1657, 1661), the corrupt 1663 *Faustus*, Mountford's farce, and Walton's version of the *Passionate Shepherd* are all that had appeared in the interval.

[100] Two other editions of *The Jew of Malta* were printed in 1810.

[101] I am not aware that any copy of this edition is now in existence. Marlowe's Lucan was included in the collection of *Poems in Blank Verse (not Dramatique) prior to Milton's Paradise Lost* by Percy and Steevens, 1807. The only copy of this that I have seen is in the British Museum and contains a MS. note by Parks: 'Received from Mr. John Nichols, at the desire of Bp. Percy in November, 1807; and in February following the whole impression was swept away in the calamitous fire which consumed the offices and warehouse of the worthy printer. Four other copies are believed to have been preserved.'

but carelessly printed and ill-edited volumes. This work nowhere gives the editor's name, but it is stated on good authority to have been George Robinson. Marlowe scholarship owes a considerable debt to his publishers, but practically nothing to him.

Modern critical and bibliographical study of Marlowe, like modern editions of his works, may be said to have begun about the middle of the eighteenth century. The Latin account of Bishop Tanner in 1748,[102] though of course faulty, manifests a spirit of inquiry more advanced than that of Phillips, Wood, Langbaine, Coxeter, and Oldys. Tanner, acknowledging his debt to Wood, writes as follows:

Marlovius (Christophorus) quondam in academia Cantabrigiensi musarum alumnus: Postea actor scenicus: Deinde poeta dramaticus tragicus, paucis inferior. Scripsit plurimas tragoedias, sc.—[*Tamburlaine*, two parts; *The Jew of Malta, Faustus, Lust's Dominion*, and *Edward II* are listed; then] "Tragedy of Dido queen of Carthage" . . . Hanc perfecit et edidit Tho. Nash, Lond. MDXCIV. 4to. *Hero et Leander* . . . Perfecit G. Chapman, et edidit Lond. MDCVI. 8vo.—Secundam hujus comoediae [*sic*] partem scripsit carmine Anglico Henricus Petow . . . . Justo Dei judicio misere vitam finiit, suo vulneratus ense, ante A. D. 1593. Petowius in praefatione ad secundam partem *Herois et Leandri* multa in Marlovii commendationem adfert; hoc etiam facit Tho. Nash in *Carmine elegiaco tragoediae Didonis* praefixo in obitum Christoph. Marlovii, ubi quatuor ejus tragoediarum mentionem facit, nec non et alterius De duce Guisio. Athen. Oxon. I. 338.[103]

It was in the latter half of the eighteenth century that actors and scholars began the systematic quest of rare Marlowe quartos. Dyce received from Mr. Bolton Corney the following vivid account of such a search in 1764. The writer is identified by Dyce as Dr. Ducarel (1713-1785), the noted antiquarian and Keeper of the Lambeth Library.

One fine summer's day, in the year one thousand seven hundred and sixty-four, going into an old book-shop kept by an old woman and her daughter, on the north side of Middle-Row, Holbourn, to look for any ancient books; not being there long, looking round the shop, before Dodd the comedian came in, to search, as he told me, for any of Kit Marlow's plays. I asked

[102] *Bibliotheca Britannico-Hibernica: sive, de Scriptoribus, qui in Anglia, Scotia, et Hibernia ad Saeculi XVII initium floruerunt . . . Auctore Thoma Tannero* . . . 1748, p. 512.

[103] Nothing is known of the alleged elegy on Marlowe's death by Nashe, which Tanner here first mentions and which Warton also asserted that he had seen. It is not found in any extant copy of *Dido*. For a discussion of the mystery see McKerrow's Nashe, ii. 335-337.

the old woman if she had any more books besides those in the shop. She said "she had; but they were in an inner room without any window-light; and that the last person that had been there was the noted book-worm Dr. Rawlinson,"—who then had been sleeping with his fathers some few years. Mr. Dodd ask'd if it was agreeable for him to accompany me. We had two candles lighted, and going into this dark recess, saw a great number of books laying on the ground, which took us some hours looking over. He brought out a book or two; but was not lucky enough to find Kit Marlow there.

It was about this time, or a little later, that Garrick assembled the rare Marlowe quartos which form the nucleus of the British Museum collection, and J. P. Kemble those that passed into the Devonshire library. A less legitimate kind of interest appears in John Berkenhout's *Biographia Literaria*, 1777. The account of Marlowe and his works on pages 357-359 of this book offers nothing that is essential; but on page 399 (note g) Berkenhout prints the following very obvious forgery, which purports to be a letter from George Peele:

Friend Marle,

I never longed for thy company more than last night: we were all very merrye at the Globe, when Ned Alleyn did not scruple to affyrme pleasantely to thy friend Will, that he had stolen his speeche about the qualityes of an actor's excellencye, in Hamlet hys tragedye, from conversations manyfold whych had passed between them, and opinyons given by Alleyn touchinge the subject. Shakespeare did not take this talke in good sorte; but Jonson put an end to the strife, wittylie remarking, This affaire needeth no contentione; you stole it from Ned, no doubt; do not marvel; have you not seen him act tymes out of number?

G: Peel.[104]

The third volume of Thomas Warton's *History of English Poetry* (1774-1781) devoted to Marlowe half a dozen pages of appreciative criticism, which, though marred by certain errors and ineptitudes,[105] furnish the most adequate judgment the poet had received since the days of the Elizabethans. On Marlowe's moral character Warton ventured a palliative construction, which, though hypothetical and defiant of tradition, remains far from improbable:

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[104] Berkenhout adds: 'Whence I copied this letter, I do not recollect; but I remember that at the time of transcribing it, I had no doubt of its authenticity.'

[105] Edmund Gosse remarks: 'I can never forgive Thomas Warton for arriving at Marlowe's *Hero and Leander* and failing to observe its beauties.' (*Two Pioneers of Romanticism: Joseph and Thomas Warton.* Proceedings of the British Academy VII, 1915.)

Marlowe's wit and spriteliness of conversation had often the unhappy effect of tempting him to sport with sacred subjects; more perhaps from the preposterous ambition of courting the casual applause of profligate and unprincipled companions, than from any systematic disbelief of religion. His scepticism, whatever it might be, was construed by the prejudiced and peevish puritans into absolute atheism; and they took pains to represent the unfortunate catastrophe of his untimely death, as an immediate judgment from heaven upon his execrable impiety.

In contradiction of this passage, the caustic Ritson seized the occasion to print for the first time the previously unknown charges of Baines.[100]

Toward the close of the eighteenth century a lively rivalry arose among the chief Shakespearean scholars of the day in the collection of the rare editions of Marlowe and the solution of the bibliographical problems they raised. Reed, Steevens, and Malone became enthusiastic connoisseurs of Marlowe. Malone paid the then extraordinary sum of sixteen guineas, at the Wright sale in 1787, for the rare *Dido*. Steevens was given a copy by Reed, and entered a grateful memorandum on a flyleaf: 'This copy was given me by Mr. Reed. Such liberality in a collector of Old Plays is at least as rare as the rarest of our dramatic pieces. G. S.'

Edmund Malone provided himself with a one-volume collection of Marlowe's works by binding together early editions of the various pieces, eked out by manuscript transcripts where originals were not obtainable. This interesting book, bound in red morocco, is now in the Bodleian (Malone 133), and is rendered additionally valuable by Malone's many manuscript annotations. Some of the last have still a significance or curious interest sufficient to warrant quotation:—

The various pieces in this volume, together with the paper into which they are let in, the expence of the inlaying, and the binding, cost five guineas. The two manuscript plays[101] are not included in this estimate. They are two of the scarcest plays extant. Mr. Capel sought for the tragedy of *Dido* for 30 years in vain. This is, I believe, the only complete collection of Marlowe's Works, now extant. E. M.

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[100] *Observations* on Warton, 1782, p. 30 ff.

[101] *Sic.* But there are no MS. plays in the volume as now made up—only a transcript of Ovid's Elegies and of the Passionate Shepherd song. The *Dido* transcript referred to is evidently the one now in the Huntington Library, which bears a note by J. P. Kemble, dated 1798: 'This copy was made by George Stevens, and given to me by Edmond Malone.'

Christopher Marlowe was of Bennet College in Cambridge, where he took the degree of B. A. in 1583, and of M. A. in 1587. He is said to have soon after gone on the stage; but I never could find any higher authority for this, than that of Philips in his *Theatrum Poetarum* 8vo. 1675; who appears to have been inaccurate in many instances. Neither Drayton, nor Decker, nor the author of *the Return from Parnassus,* nor B. Jonson, nor Heywood in his prologue to the *Jew of Malta,* mention Marlowe as an Actor; tho' M^{r}. Warton in his *Hist. of Poetry* Vol. III. p. 436 (note t) says the contrary; but he certainly is mistaken.

Oldys in one of his Mss. says, Marlowe was born about the beginning of the reign of Edward VI.; but he was certainly born in the time of Elizabeth, probably in 1565, the year next to that which gave Shakspeare birth, for we cannot well suppose that he was more than 19 when he took his Bachelor's degree in 1583-4. S$^{r.}$ Henry Wotton took the degree of Master of Arts in 1578, at the age of twenty.

The earliest authority I have found for the manner of his death is that of Francis Meres, in his *Palladis Tamia,* Wits Treasury &c. 8vo. 1598: [quotation follows].

This circumstance is likewise related by Beard in his *Theatre of God's Judgment,* lib. I. ch. 25, and by A. Wood in his *Athen. Oxon.* The latter says it happened in a brothel some time before the year 1593. I imagine it was on Whitsun Tuesday in 1592 (See the paper below). Peele in a poem published in June, 1593, mentions his unhappy end.

The following curious account of our author's tenets is preserved in the British Museum, Mss. Harl. 6853-80. fol. 320: [The Baines libel transcribed in full].

This Richard *Bame* or *Banes* was *hanged* at Tyburn, on the 6$^{th.}$ of Dec$^{r.}$ 1594. See the Stationers' Register Book B. p. 316.

It is obvious to remark upon this testimony, that it is *not upon oath*—that it contains some declarations which it is utterly incredible that Marlowe should have made (as that concerning his intention to coin, which he must have known to be penal); that Bame does not appear to have been confronted with the person accused, or cross examined by him or any other person; and that the whole rests upon his single assertion. This paper, however, may derive some support from the verses quoted at the other side from the *Returne from Parnassus,* which was written about 10 years after Marlowe's death.

Malone then adds a list of 'Testimonies concerning C. Marlowe,' consisting of quotations from Meres, Peele, Nashe (*Lenten Stuff*), Petowe, *The Return from Parnassus,* Drayton, Jonson, and Phillips.

An unpublished document among the Windham Papers in the British Museum (Additional MSS. 37, 854, ff. 156, 157) exhibits Malone's painstaking methods of research, though in this case he was following a false scent in assuming that Marlowe may have come from Norwich or its vicinity and may have held one of the Norwich scholarships established by Parker. The letter, which reads as follows, is in Malone's hand, and is endorsed in pencil: 'encl(osed) in lr. of Windham to Amyot 11 Sept. '04':

Archbishop Parker founded several Scholarships in Corpus Christi College in Cambridge, to which, when vacancies should happen, the Corporation of Norwich were entitled to nominate. Christopher Marlin, Marley, or Marlowe (for in all these ways his name was written), was nominated a Scholar by the Corporation in the year *1580;* and it is supposed that in the corporation books of that year there is an entry of such nomination. If that shd. be the case, Mr. Malone requests to know, whether his parents are mentioned, and whether he is described as born in Norwich, or Wymondham, or Aylsham, from the schools of any of which places the Corporation were empowered to select such persons as they chose to nominate. When by this means the parish of Christopher Marlin is obtained, it will be easy to learn the exact time of his birth; which is sought for on account of his being a celebrated Poet of those times.

The reply, dated 8 Oct., 1804, says that the Books of the Court of Mayoralty and other records belonging to the Corporation of Norwich have been searched in vain, and that other inquiries in Norfolk have been without success.

It is thus evident that the researches of eighteenth-century professional scholars like Warton, Ritson, Reed, Steevens, and particularly Malone, had led to a considerable increase in knowledge of Marlowe and his works. This knowledge, however, had hardly extended beyond a small academic circle.[108] In 1808, appeared Charles Lamb's *Specimens of English Dramatic Poets Contempo-*

[108] Evidence that others, besides actors and professional critics, were at this time reading Marlowe quartos is found in Walter Scott's *Notebook.* Under date of May 26, 1797, Scott quotes three lines of *Doctor Faustus* (ll. 815-817):

'There saw we learned Maroe's golden tombe;
The way he cut an English mile in length
Thorow a rock of stone in one night's space;'

and adds: 'Christopher Marlowe's Tragicall History of Dr. Faustus—a very remarkable thing. Grand subject—end grand.' (Lockhart, *Life of Scott,* chapter viii.)

Thomas Dermody, the precocious Irish poet, who died in 1802 at the age of twenty-seven, left a burlesque piece called *Dr. Faustus's Panegyric* and some lines in *The Pursuit of Patronage,* which, however sentimentalized, show a real appreciation of Marlowe's genius:

'Who, led by sweet Simplicity aside
From pageants that we gaze at to deride,
Has not, while wilder'd in the bow'ry grove,

rary with Shakespeare, which ultimately became an important influence in restoring Marlowe's reputation. Lamb's praise of the death scene in *Edward II* is, of course, famous. In commenting on Porter's *Two Angry Women of Abingdon* (in the later *Extracts from the Garrick Plays*, 1827), he refers to Marlowe as the 'true, though imperfect, father of our tragedy.' Elsewhere he says: 'The sweetest names and which carry a perfume in the mention are Kit Marlowe, Drayton, Drummond of Hawthornden, and Cowley.' Both in the *Specimens*, however, and in his later writings, Lamb devotes little attention to Marlowe as compared with other favorite writers.[109] Coleridge hardly mentions him.[110]

Oft sigh'd: "Come, live with me, and be my love"?
Yet, oh! be love transformed to deadly hate,
As freezes memory at Marlow's fate:
Disastrous bard! by too much passion warm'd,
His fervid breast a menial beauty charm'd;
Nor, vers'd in arts deceitful woman knows,
Saw he the prospect of his future woes.
Vain the soft plaint, that sordid breast to fire
With warmth refin'd or elegant desire;
Vain his melodious magic, to impart
Affections foreign to th' unfeeling heart;
In guardless ecstacy's delicious glow,
He sinks beneath a vassal murd'rer's blow.
O'er his dread fate my kindred spirit stands
Smit with commutual wound, and Pity wrings her hands.
Ah! had some genial ray of bounty shone
On talents that but lack'd its aid alone,
Had some soft pennon of protection spread
Its eider plumage o'er that hapless head,
What emanations of the beauteous mind
Had deck'd thy works, the marvel of mankind:
Snatch'd from low-thoughted Care thy stooping soul,
And plac'd thee radiant on Fame's deathless roll;
Where still anneal'd, thy own unequall'd strain
Shall crown'd by sensibility remain!'

[109] Of *Tamburlaine*, Lamb says: 'I had the same difficulty (or rather much more) in culling a few sane lines from this as from the preceding Play [*i.e.*, *Lust's Dominion*, which is also ascribed to Marlowe]. The lunes of Tamburlaine are perfect "midsummer madness." Nebuchadnezzar's are mere modest pretensions compared with the thundering vaunts of this Scythian Shepherd . . .' For two flattering remarks on 'old Christopher Marlow' in Lamb's letters, see Lucas's ed. pp. 126 f. and 631.

[110] See, however, Coleridge's *Table Talk*, Feb. 16, 1833. 'Before I had

A book published in the year of Malone's death (1812), the *Biographia Dramatica* (vol. I. pt. ii. pp. 491-493), gives a typical estimate for the benefit of the general public. We here read that Marlowe

> lived in the reign of Queen Elizabeth, and was not only an author but an actor also, being very considerable in both capacities. There is no account extant of his family, but it is well known that he was of Bennet College . . . He, however, quitted the academic life, and went on the stage.

An account of his death, from Wood, follows; his atheism is deplored.

> Let us now consider him as a poet, and in this light he must be allowed to have had great merit. His turn was entirely to tragedy, in which kind of writing he has left the six following testimonials of his abilities: 1. *Tamburlaine.* 2 parts. I. 4to. 1590; II. 4to. 1606. 2. *Edward II.* 1598. 3. *Massacre at Paris.* 8vo. n. d. 4. *Faustus* 4to. 1604. 5. *Jew of Malta.* 4to. 1633. 6. *Lust's Dominion; or The Lascivious Queen.* T. 12mo 1657; 12mo. 1661. He also joined with Nash in writing *Dido* 4to. 1594, and began *Hero and Leander.* He also joined with Day, in *The Maiden's Holyday.* 1654. N. P.

How very little Marlowe was generally appreciated in the age of Keats and Byron appears from two notices of *Doctor Faustus.* The author of the preface to the 1814 (?) edition of the play writes of it:

> This singular evidence of "the credulous ignorance" which then prevailed, is by no means a favourable specimen of the plays to be submitted to the public in this work; but it was the first in chronological order, and of too much consequence to be passed over altogether. Whoever shall attempt to judge of it by dramatic rule, will find himself baffled in every attempt, and, according to his humour, laugh or censure . . .

And H. M. (Henry Maitland) contributes an article to the first volume of *Blackwood's Magazine* (July, 1817), in which he says:

> As in all probability the greater number of our readers are unacquainted with this very singular composition, and as, independently of its own great merits, it possesses an extraordinary interest at the present time, from the general resemblance of its subject to that of Lord Byron's last poem [Manfred], we now shall give an analysis of it, accompanied with extracts sufficiently copious to exhibit its peculiar spirit and character.

ever seen any part of Goethe's *Faust*, though, of course, when I was familiar enough with Marlowe's, I conceived and drew up the plan of a work, a drama, which was to be, to my mind, what the Faust was to Goethe's. My Faust was old Michael Scott . . . He did not love knowledge for itself—for its own exceeding great reward—but in order to be powerful.'

A review of *Manfred* had appeared in the previous (June) number of *Blackwood's*. In the following October number Maitland gives an analysis also of *Edward II*, in the course of which he refers to a criticism in the *Edinburgh Review* of his previous discussion of *Faustus* and says:

That "Faustus" is, as a composition, very inferior to Manfred, we perfectly agree with the Reviewer; for the wavering character of the German magician will not bear comparison for a moment with that of the Princely Wanderer of the Alps; and the mixed, rambling, headlong, and reckless manner of Marlow, in that Play, must not be put into competition with the sustained dignity of Byron.

Nathan Drake's large and influential book on *Shakespeare and his Times* (1817) gives Marlowe short shrift. He is thus described:

as an author, an object of great admiration and encomium in his own times, and, of all the dramatic poets who preceded Shakespeare, certainly the one who possessed the most genius. He was egregiously misled, however, by bad models, and his want of taste has condemned him, as a writer for the stage, to an obscurity from which he is not likely to emerge.' (Vol. ii., p. 245.)[111]

Not even does there seem to have existed at this period any clear impression of Marlowe's personal existence. An anonymous writer in the *Monthly Review*, August, 1819, in the course of a discussion of Drake's *Shakespeare and his Times*, offers an astounding theory:

There is, however, something very enigmatic about this Christopher Marlowe. Of his birth-place and early years, nothing is known: but, just at the time when Shakspeare left Stratford, he appears on the London boards as a distinguished actor, and an admirable play-wright both in tragedy and comedy . . . Marlowe issued a pastoral ballad, entitled *The Passionate Shepherd* which Shakespeare afterward claimed, and inserted in his own edition of *The Passionate Pilgrim*. Shortly afterward, in 1592 [*sic*] an improbable story was circulated, that Marlowe had been assassinated with his own sword, which attracted no judicial inquiry; and Shakspeare became

[111] Gifford expresses a more favorable judgment in his comment on Jonson's phrase about Marlowe (Works of Jonson, 1816, vol. viii, p. 330): '*Marlowe's mighty line* is not introduced at random. Marlow has many lines which have not hitherto been surpassed. His two parts of *Tamburlaine*, though simple in plot and naked in artifice, have yet some rude attempts at consistency of character, and many passages of masculine vigour and lofty poetry . . . Marlowe had the sublimity of Milton, without the taste and inspiration. It is not just to consign him to ridicule.'

immediately the same distinguished actor, the same admirable play-wright, that Marlowe had been just before. Can Christopher Marlowe have been a *nom de guerre* assumed for a time by Shakspeare? We know that actors often make their *debut* under feigned names; and, if Shakspeare quitted home for any purpose of concealment, this policy was peculiarly natural . . . This much is certain, that, during the five years of the nominal existence of Marlowe, Shakspeare did not produce a single play . . . and that, from the moment of Marlowe's nominal decease he produced at least two annually.[112]

Public interest in Marlowe's plays was much increased by Edmund Kean's revival of the *Jew of Malta*, April 24, 1818, and by the controversy which this production led to. Apart from the harlequin perversions of *Doctor Faustus*, by Mountford, Thurmond, and Rich, this seems to have been the first performance of a play by Marlowe since the *Faustus* of 1663. The acting text, prepared by Samson Penley, is of sufficient interest to merit analysis. It is marked by large, but unacknowledged, plagiarisms from *Edward II*.[113]

Act I, scene i, 'A Landscape, near Malta,' opens with Mathias, 'reading a letter':

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[112] In a review of Hazlitt's Lectures on the Age of Elizabeth in the same periodical, September, 1820, the writer refers again to his theory:

'We had occasion not long ago to throw out the suspicion that Christopher Marlowe is but a borrowed designation of the great Shakspeare, who disappears from all biographical research just at the moment when Marlowe first comes on the stage; and who re-appears in his proper name in 1592, when a strange story was put in circulation that Marlowe had been recently assassinated with his own sword, which may be allegorically true.' Note a curious revival of this suggestion, spontaneously and on different reasoning, by T. C. Mendenhall: *Did Marlowe Write Shakespeare?* Current Literature XXXII. 149-151, February, 1902. Very recently certain opponents of the so-called Stratfordian understanding of Shakespeare have hit upon the same idea.

[113] 'Marlowe's Celebrated Tragedy of the Jew of Malta. In Five Acts. With Considerable Alterations and Additions By S. Penley, Comedian. As Performing with unanimous Approbation at the Theatre Royal, Drury-Lane . . . 1818.' Genest (1832) who assumed the passages from *Edward II* to be original with Penley, remarks (viii, p. 647): 'as is usual in these cases, he has inserted too much of his own, and omitted too much of the original' Genest's analyses of plots show that he had read Marlowe's plays, but reveal no critical appreciation. In regard to Mountford's farce, he says (i, p. 452): 'Marlowe has drawn the character of Faustus with the hand of a master, and has written many passages very finely, but as he represents all that happens to Faustus as matter of fact, his play is of course a strange one—Mountfort has more judiciously represented the story as farcical.'

"My father is appeas'd—come dear Mathias,
And greet with holy rites, thine anxious love."
Ah! words, that make me surfeit with delight!
What greater bliss can happen to Mathias?—
Sweet girl, I come, for these thy am'rous lines
Might have enforced me to have swum from France,
And, like Leander, gasp'd upon the sand,
So thou would'st smile, and take me to thy arms.
The sight of Malta to my exil'd eyes,
Is as Elysium, to a new-come soul:
Not that I love the city, or the people,
(Save my kind mother, and my trusty friend)
But that it harbours her I hold so dear;
Fair Abigail, daughter to Malta's jew [*sic*],
And tho' my kindred all, with low'ring brow,
Forbid the dawning pleasure of our love,
I heed them not—in her arms let me lie,
And with the world be still at enmity.
(Cf. *Edward II*, ll. 1-15.)

A dialogue between Mathias and Lodowick follows, in which it appears that each is secretly in love with Abigail.

Scene ii opens with the great soliloquy of Barabas (Kean)—the real beginning of Marlowe's play. Lines 121-140 of the original are omitted, as are ll. 413-423, 429-441, and 608-639, the last having been anticipated by the new scene i. Before the entrance of del Bosco (l. 706) a preparatory scene between two Knights is inserted. Lines 752-756, 762-767, and 769-771 are omitted; and ll. 796-798 are replaced by six lines taken with slight alteration from the omitted scene, 608 ff. The purchase of Ithamore in Act II, scene iii, is considerably altered from the original; the end of this scene corresponds with line 925 of Marlowe. Scene iv (wrongly marked 'Scene iii') opens with more plagiarism from *Edward II*, in a soliloquy of Abigail:

The grief his exile gave, was not so much,
As is the joy of his returning home;
What need'st thou, love, thus to excuse thyself,
I knew 'twas not within thy pow'r, again
So soon to visit me . . . .
And yet this argues his entire affection.
(Cf. *Edward II*, ll. 777-783)
But see my father homeward bends his steps,
Once more, I'll importune with him my pray'r, [*sic*]
But e'er he shall dissuade me from my love,

This isle itself, shall fleet upon the ocean,
And wander, to the unfrequented Inde.
So well Mathias has deserv'd of Abigail.
(Cf. *Edward II,* ll. 343-345)

The scene then continues with the conversation between Barabas and Ithamore (ll. 928 ff.). Instead of ll. 1126-1128, a new speech of nine lines by Abigail is inserted. The scene of the death of Mathias and Lodowick is expanded, seven lines being added after Marlowe's 1183 and nearly fifty lines after 1185. Between ll. 1247 and 1248 of Marlowe the reviser again introduces a plagiarism from *Edward II:*

Oh day! the last of all my bliss on earth,
Centre of all misfortunes!—heavenly powers!
Why do you low'r thus unkindly on me? (*Edward II*, 1928-30.)

Oh might I never ope these eyes again!
Never again, lift up this drooping head!
Oh! never more lift up this dying heart.
Ith. How now mistress—wherefore this lament?
Abi. Yes—'tis my only home, for whither else
Shall wretched Abigail presume to fly?
Oh never to an unrelenting Father,
Whose eyes vindictive, being turn'd to steel,
Will sooner sparkle fire, than shed a tear. (*Edward II*, 2090 f.)

Before line 1258, two other lines from *Edward II* (2097 f.) are given to Abigail:

Come death, and with thy fingers close my eyes,
Or if I live, let me forget myself.

Lines 1270-1278 are replaced by the following:

(*Enter* Jacomo.)

(*Abigail*). Oh holy friar to thee I fly for comfort—
Cheer, I beseech thee, a distressed soul.
And all in pity of my wretched state,
Assuage the horrors of a fell despair.
Jacomo. Wherein good daughter is it, I can serve thee?
Abi. By shielding me within some holy walls
In true contrition for—another's crimes.

After l. 1302, which closes Act III, sc. i, of Penley, the reviser transposes the order of scenes. Lines 1420-1456 follow as scene ii; then, as scene iii, a largely rewritten version of ll. 1465-1496, which represent Abigail as dying from natural causes. In the next scene (Act IV, sc. i), lines 1303-1349 and 1529-1653 (reduced and altered) are thrown together. Thus the poisoning of Abigail and the nuns is omitted, as well as the device by which Friar Jacomo is hanged. Consequently, in what corresponds to ll. 1733 ff., Ithamore is represented as watching a pirate's execution, not a friar's.

In Penley's version of ll. 1950-2001, the poisoning is portrayed in a more conventional manner than in Marlowe: '*As they take the Flowers from Barabas, he draws a small packet from his bosom, and throws the contents into the two goblets.* Between lines 1969 and 1970 of Marlowe, a distinctly original song is inserted:

Barabas Plays and Sings.

Scarce had the purple gleam of day
  Glanc'd lightly on the glowing sea,
When forc'd by fortune's shafts away,
  My native land, I quitted thee.

There tho' the sable raven soar,
  And nightly screams her death-fraught yell,
Tho' rav'ning ban dogs bay the door,
  And howling wolves o'erpace the dell.

Tho' ice-winged tempests fret the sky,
  And chill the early flow'rets bloom,
Tho' still we see our rosebuds die,
  And in the snow the lillies tomb.

And these tired feet each soil have press'd,
  Where joy and pleasures seem to be,
Where all by smiling Heav'n is blest,
  Still, native land, I sigh for thee.

Between lines 2051 and 2052 Penley inserts two new speeches (15 lines) by Katherine and the Governor. The difficulty of Barabas's recovery on stage is avoided by substituting for Marlowe's soliloquy (ll. 2063-2070) an explanatory scene between Calymath and Calapine. Between lines 2279 and 2280 occurs a last echo of *Edward II:*

Gov. But be careful,
For now we hold on old wolf by the ears,
That if he slip, will seize upon us all,
And gripe the sorer, being gript himself.
(Cf. *Edward II*, 2149-2151.)

The final catastrophe is thus conventionalized:—'*A charge is sounded—cannon heard at a distance—the curtains of the side galleries are suddenly drawn and discover soldiers with their calivers levelled at Barabas—who, startled at the unexpected danger, endeavours to escape—they fire, and Barabas in descending the stairs is shot.*'

About twenty-five lines of the conclusion (2346-2410) are omitted, particularly lines derogatory to the Jews. 'The extremity of heat' in line 2371 becomes 'the wrenching gripe of death.'

The New Monthly Magazine (vol. 9, 1818, pp. 444, 445) printed a flattering review of Kean's production:

April 24th, the long announced tragedy of *The Jew of Malta*, altered from the original of Christopher Marlowe, was produced. . . . The character of the Jew, which is still unnatural though it has undergone considerable alteration, is nevertheless drawn with great energy and is precisely of that cast which Kean's talents are calculated to render with the strongest effect. He completely seized the spirit of his author, and placed before us the boldest picture of cunning and revenge we ever beheld. In the first act, which is the best in the piece, his performance was particularly fine; but throughout the whole, wherever passion could be moved, he succeeded in eliciting it. In the fourth act he sung a pretty air with considerable science as well as with taste and feeling, and was warmly encored. Mrs. Bartley sustained the part of Abigail very effectively. Ferneze, Don Mathias, and Don Lodowick were well represented by Pope, Stanley, and Wallack, and Ithamore by Harley. The prologue was delivered by Barnard, the epilogue by Mrs. Bartley; and the tragedy was announced for representation amidst universal applause.

The fact seems to be that the piece was by no means an unqualified success, though it was acted (according to Genest) twelve times. It led to considerable controversy, partly connected with a quarrel between Kean and Charles Bucke, whose tragedy of *The Italians* had been withheld from performance to make room for the *Jew of Malta*. Bucke's preface to his tragedy, printed in 1819, illustrates the situation. He had been asked, he says, to write a prologue for the *Jew*. 'This,' he says,

I thought proper to decline:—first, because I felt a reluctance to be, in any way, assisting in the revival of a Tragedy, so barbarous, and so entirely unfitted for the present age, as the JEW OF MALTA: but, principally, because I felt ashamed, in being accessory to the cruelty of offering such an undeserved, as well as unprovoked, insult to the great body of the Jews:—all of whom took so much offence at the representation—particularly as it occurred during the week of the Passover,—that for the whole of the remaining season, it was more difficult to recognize a Jew in the house, than even a Woman of Fashion.[114]

The second of Hazlitt's Lectures 'Chiefly on the Dramatic Literature of the Age of Elizabeth' (1820) contains some fifteen pages of Marlowe criticism. The poet is here grouped—in contrast with such well-known names as Ben Jonson, Massinger, Beaumont, and Fletcher—among a set of writers 'who are next, or equal, or sometimes superior to these in power, but whose names are now little known, and their writings nearly obsolete.' 'Marlowe,' Hazlitt says,

> is a name that stands high, and almost first in this list of dramatic worthies.. . . There is a lust of power in his writings, a hunger and thirst after unrighteousness, a glow of the imagination, unhallowed by anything but its own energies. His thoughts burn within him like a furnace with bickering flames; or throwing out black smoke and mists, that hide the dawn of genius, or like a poisonous mineral, corrode the heart.

Hazlitt devotes most of his attention to *Doctor Faustus*, which, 'though an imperfect and unequal performance, is his greatest work,' and to *Lust's Dominion*, which he thinks most resembles it. The *Jew of Malta* he does not think 'so characteristic a specimen of this writer's powers'; and he regards *Edward II* as weak in most respects, though 'according to the modern standard of composition, Marlowe's best play.'

The most immediate successor to Malone in the serious study of Marlowe's life and work was probably James Broughton. His edition of *Tamburlaine*, prepared in 1818, but not published, has been mentioned. It was he who in 1820 discovered the record of the poet's burial in the Church of St. Nicholas, Deptford, thus verifying Vaughan's account[115] in this detail. In 1821 he searched

[114] The sequel is given in the *Monthly Magazine*, vol. 53, Part I for 1822, p. 59: 'During the controversy relative to Mr. Bucke's Tragedy, it may be remembered, that the author stated in his preface, that he had not only refused to write an Epilogue (*sic*), but that he had declined being in any way instrumental, in attempting to revive the drama of the "Jew of Malta," because "he felt ashamed in being accessory to the cruelty of offering such an undeserved and unprovoked insult to the great body of the Jews." This conduct having given great satisfaction to the Jews, a select society of them have determined upon presenting Mr. Bucke with a splendid copy of the "Talmud of Babylon," and an illuminated one of the "Talmud of Jerusalem."

[115] See above, p. 356.

the records of Bene't College (Corpus Christi), but found no entry of Marlowe's name (the spelling *Marlin* presumably blinded him). A couple of articles which he contributed to the *Gentleman's Magazine* in 1830, 'Of the Dramatic Writers who Preceded Shakespeare, and especially of Christopher Marlowe,' gave the most elaborate criticism of the poet yet attempted. Broughton's manuscript annotations in a copy of the Robinson edition of 1826, now in the British Museum, are still of considerable value.[116]

J. P. Collier's *Poetical Decameron* (1820), which attempted to give popular interest to the minutiae of criticism, contains some new points regarding Marlowe; others were added in Collier's notes on *Edward II* and *The Jew of Malta* in the 1825 Dodsley. Much more did Collier's *History of English Dramatic Poetry to the Time of Shakespeare* (1832, 2d. ed. 1879) contribute to fix Marlowe's place among his contemporaries and point out new sources of information. Though Marlowe, only less than Shakespeare, became the unfortunate subject of Collier's forgeries, the fact remains that students of the former poet have gained far more than they have suffered by his indefatigable activities. So much can hardly be said of a later pioneer in dramatic research, F. G. Fleay, whose many well-intentioned pages of Marlowe criticism contain relatively little that is helpful.

More modern in tone than those of Collier and more final than Fleay's are the judgments of Henry Hallam in the three pages assigned to Marlowe in his *Introduction to the Literature of Europe in the 15, 16 and 17 Centuries* (1837--39). Hallam's succinct appraisal has left little for more recent critics to unsay or dispute. Of *Tamburlaine* he remarks: 'This play has more spirit and poetry than any which, upon clear grounds, can be shown to have preceded it. We find also more action on the stage, a shorter and more dramatic dialogue, a more figurative style, with a far more varied and skilful versification.' 'The first two acts of the Jew of Malta are more vigorously conceived, both as to character and circumstance, than any other Elizabethan play, except

[116] Other manuscript materials (likewise in the British Museum) which bear on the history of Marlowe scholarship are the *Collectanea Ecclesiastica* of Thomas Baker (1656-1740; Harleian 7042) and the *Chorus Vatum* of Joseph Hunter (1783-1861; Additional MSS. 24, 488). Hunter frequently copies from Baker.

those of Shakespeare.' 'There is an awful melancholy about Marlowe's Mephistopheles, perhaps more impressive than the malignant mirth of that fiend in the renowned work of Goethe.' Of the historical plays founded upon English chronicles, *Edward II* 'is certainly by far the best after those of Shakespeare.' 'No one could think,' Hallam concludes, 'of disputing the superiority of Marlowe to all his contemporaries of this early school of the English drama.'

Leigh Hunt's *Imagination and Fancy* (1844) praises Marlowe eloquently, though in somewhat general terms. 'If ever there was a born poet,' he says, 'Marlowe was one. He perceived things in their spiritual as well as material relations, and impressed them with a corresponding felicity.' He 'prepared the way for the versification, the dignity, and the pathos of his successors, who have nothing finer of the kind to show than the death of Edward the Second—not Shakespeare himself . . . Marlowe and Spenser are the first of our poets who perceived the beauty of words; not as apart from their significance, nor upon occasion only . . . but as a habit of the poetic mood, and as receiving and reflecting beauty through the feeling of the ideas.'[117]

Modern understanding of Marlowe probably owes most of all to Alexander Dyce, whose edition of the poet appeared in 1850, and in revised form in 1858. It is not likely that any other book will ever bring together more new information relating to this writer, interpreted with sounder judgment, than is to be found in Dyce's introductory *Account of Marlowe and his Writings*. Cunningham's edition (1870, etc.) added nothing to Dyce, and Bullen's (1884-85) very little. In the way of general criticism, the essays of Lowell, Dowden, and Symonds are still of interest, as are the more exuberant writings of Swinburne, who throughout his life made a special cult of Marlowe. Sir Adolphus Ward's *History of English Dramatic Literature* (1st ed., 1875) contains solid and valuable criticism; while his steadily revised editions of *Doctor Faustus* in the *Old English Drama* (1st ed. 1878; 4th ed. 1901) register the advances made in the study of that play.

A tasteless memorial to Marlowe at Canterbury was unveiled

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[117] Creizenach remarks, for no very clear reason: 'Die eigentlichen Erneuerer von Marlowes Ruhm sind Hazlitt und Leigh Hunt.' (*Geschichte des neueren Dramas* IV. 495.)

by Henry Irving in 1891, speeches being made on the occasion by Irving, Edmund Gosse, and Frederick Rogers.[118] J. H. Ingram's *Christopher Marlowe and His Associates* (1904) contains valuable facsimiles of Marlowe documents, some bibliographical information, and previously unpublished transcripts of Canterbury wills, made by relatives of the poet. Otherwise this book and its briefer replica, *Marlowe and His Poetry* (1914), contribute little. The most important recent discoveries concerning Marlowe's life are the Corpus Christi College records of his residence, published by Professor G. C. Moore Smith ('Marlowe at Cambridge,' *Modern Language Review*, 1909). Professor Boas's investigations of the connection between Kyd and Marlowe ('New Light on Marlowe and Kyd,' *Fortnightly Review*, 1899; *Works of Kyd*, 1901) and M. F.-C. Danchin's of the atheistic scandal in which Marlowe was involved (*Rèvue Germanique*, 1913-14) brought out some new material, as did Sidney Lee's article in the *Dictionary of National Biography* (1893).[119]

Appreciation of Marlowe on the continent of Europe began in Germany in the time of Tieck and A. W. Schlegel. Goethe spoke high praise of *Doctor Faustus* in conversation with Crabb Robinson (1829): 'I mentioned Marlowe's *Faust.* He burst out into an exclamation of praise. "How greatly it is all planned!" He had thought of translating it. He was fully aware that Shakespeare did not stand alone.' The first German translation of this play, by W. Müller, appeared in 1818. E. von Bülow's *Altenglische Schaubühne* (1831) added versions of the *Jew of Malta* and *Edward II*, and M. Vöhl one of the first part of *Tamburlaine* in 1893. The two hundred and twenty pages devoted to Marlowe in the third volume of Friedrich Bodenstedt's *Shakespeare's Zeitgenossen und ihre Werke* (1860) may be said to have paved the way for the very extensive recent investigation of the poet in Germany.[120]

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[118] See accounts in the *Saturday Review*, Sept. 19, 1891, and in the *Spectator* of same date.

[119] In the *Athenaeum* (Aug. 18, 1894) Lee called attention to 'Another new Fact about Marlowe' (the bond of 1588). Mr. F. K. Brown published in the *Times Literary Supplement*, June 2, 1921, a previously unprinted letter of Kyd concerning Marlowe.

[120] Bodenstedt gave a complete translation of *Faustus*, ed. 1616, with discussions and specimen translations of other plays.

In France, F.-V. Hugo's translation of *Faustus* (1858) and A. Mézières' discussion in *Les Prédecesseurs et Contemporains de Shakspere* (1863) evidence the beginning of serious interest. Félix Rabbe produced a translation of the collected plays in two volumes (1889), which evoked essays on the poet by Jules Lemaître (*Impressions de Théâtre*, Cinquième Série, Oct. 14, 1889) and J. Texte (*Révue des Deux Mondes*, 1890). In Italy, Arturo Graf's *Studii drammatici* (1878) contained a forty-page essay on *Il Fausto di Cristoforo Marlowe*. The first Italian version of the play was made by Eugenio Turiello (Naples, 1898); *Edward II* followed in the first volume of Raffaello Piccoli's *Drammi Elisabettiani Tradotti* (1914). A Spanish version of *Faustus* by Alcalá-Galiano was published in 1911, and a Polish version in 1912. Dutch, Danish, and Swedish translations had previously appeared.[121]

Though Marlowe's plays have not as yet established themselves on the professional stage, academic or semi-professional performances have of late been increasingly successful. *Doctor Faustus* has been many times presented before limited audiences, particularly, since 1896, under the management of Mr. Wm. Poel for the Elizabethan Stage Society.[122] Notably successful academic revivals were given at Princeton University in 1907 and at Williams College in 1908. *Edward II* was given at the Oxford Summer Meeting, 1903, by the Elizabethan Stage Society.[123] A perform-

[121] A passage from the introduction to Pinkerton's selections from Marlowe (1885) speaks as follows: 'Marlowe has not yet got the ear of Europe. In England even, few comparatively give him high regard; abroad, he still counts as a barbarian. Germans may sympathize, perhaps, with one who first touched their great Faust-legend; the French have never seen more in him than a wild pioneer and road-breaker for Shakespeare. A distinguished modern Italian poet and critic, in verses made by him while reading Marlowe, expressed the belief that his author seemed to have been inspired by the fumes of beer. Truly a fine criticism, a subtle inference this, to deem all Marlowe's "mighty lines" as but the outcome of beer! From such a singular judgment we may conclude that foreigners, with their curious slowness to appreciate any Anglo-Saxon poets but Byron and Shakespeare, have not yet got at the true Marlowe.'

[122] The *Saturday Review* (vol. 82, p. 36 f.) speaks well of a performance, 'Acted by members of the Shakespeare Reading Society at St. George's Hall, on a stage after the model of the Fortune Playhouse', 2 July, 1896.

[123] A spectator of this revival of *Edward II* wrote: 'The wonder is not so much that it should have held spellbound an audience, some of whom,

ance of the *Jew of Malta* at Williams in 1909 was commemorated by the publication of a handsome acting text, with an introduction on the staging of the play. *Tamburlaine* (the two parts condensed) was produced by the Yale Dramatic Association in June, 1919, and *Edward II* by students of Birkbeck College, London, in December, 1920.

The progress of Marlowe's reputation during the last century can be roughly gauged by the succession of imaginative works dealing with his life and death. The most important are the following:

1. Ludwig Tieck, *Dichterleben*, 1826
   An interesting novel. The first part closes with the death of Marlowe, slain by the rustic (Yorkshire) footman, Ingeram (*sic*).

2. R. H. Horne, *The Death of Marlowe*, 1837 (New issue, 'with some additions,' 1870). Reprinted in Bullen's Marlowe. A worthless piece, grossly overpraised by Bullen, execrated by Swinburne. Marlowe is slain at the Triple Tun, Blackfriars, by one Jacconot.

3. Ernst von Wildenbruch, *Christoph Marlow*. Trauerspiel in vier Akten, 1884. A distinctly interesting, if over-sentimental and quite unhistoric, play. It owes a large debt to Tieck.

4. W. L. Courtney, *Kit Marlowe's Death*. Printed in the *Universal Review*, 1890. Produced by Arthur Bourchier at the Shaftesbury Theatre, July 4, 1890; revived at St. James's Theatre, 1892.

5. James Dryden Hosken, *Christopher Marlowe, A Tragedy*, 1896.

6. Josephine Preston Peabody, *Marlowe, A Drama in Five Acts*, 1901. First acted at Radcliffe College, June 19, 20, 1905.

7. Sara Hawks Sterling, *Shakespeare's Sweetheart*, 1905.
   Imaginary reminiscences of Anne Hathaway. Marlowe, a reckless but inspired drunkard, plays Tybalt in *Romeo and Juliet*.

8. Alfred Noyes, *Tales of the Mermaid Tavern*, 1913.
   ii. A Coiner of Angels; iv. The Sign of the Golden Shoe.

9. Clemence Dane, *Will Shakespeare*. A Four Act Drama in Blank Verse. 1922. Marlowe is accidentally killed by Shakespeare in the third act.

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perhaps many of whom, were not educated in dramatic literature, as that it should all these years have been neglected of managers.' (Cf. *Athenaeum*, March 7, 1914.)

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