

Genetic Studies in Relation to Kuru. I. Cultural, Historical, and Demographic Background

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INTRODUCTION

The probable importance of a genetic factor in the etiology of kuru was suggested in the first paper published on the disease [1]; since then, many genetic studies have been carried out on populations in the Eastern Highlands of New Guinea living within or adjacent to the kuru region (fig. 1). Genealogical data were collected and analyzed by Bennett et al. [2, 3], on the basis of which they proposed a single-gene hypothesis for kuru. At the same time, Gajdusek and Zigas [4] began a detailed phenotypic study of the region to see whether kuru susceptibility was associated with any of the known human polymorphic markers. Certain difficulties with the single-gene hypothesis were pointed out by Bennett et al; their work was later extended [5-7], but no deeper or wider genealogical analysis has since been made. The specific objections to the single-gene hypothesis for kuru were taken up again by Williams et al. [8]. The more general arguments by geneticists and anthropologists against the genetic hypothesis were not based on a knowledge of the specific facts related to kuru and the kuru region and need no longer concern us. However, it seemed clear from the outset that a purely genetic explanation for a disease at once highly prevalent and highly lethal, with no apparent concomitant heterozygote advantage, did not hold much promise. Nevertheless, the pattern of occurrence of kuru (figs. 2, 3), throughout 15 years of investigation, has continued to suggest a genetic determination of its expression, although the associated operation of environmental factors has become increasingly clear [9-11]. These environmental factors now seem to be defined: an infectious agent with long incubation period (a slow virus [12, 13]) and the practice of cannibalism, to which we can attribute the wide and rapid spread of the agent through the population [14-16].

The virus of kuru and its dissemination through cannibalistic ritual are of key importance in the etiology of the disease; however, it is not true that because we have uncovered such causes that this necessarily demonstrates the invalidity of a genetic hypothesis. Nor is it true that the unlikelihood of one genetic hypothesis proves that genetic factors are not operative in the etiology of the disease. Whatever the social and environmental causes for kuru, there is yet to be found a case

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FIG. 1.—Map of the island of New Guinea, showing the location of the kuru area in the Eastern Highlands. Shaded area indicates terrain of over 200 m above sea level.

of transmission of the disease to outsiders, whether through contact with patients living in the kuru region environment, or participating in the kuru region cultures. To discriminate between the parts played by genetics and cannibalism in the etiology of kuru, we need reliable data on both factors pertaining to specific individuals; such data, on cannibalism at least, are unfortunately no longer available.

The Fore are the linguistic group most susceptible to the disease and among whom over 80% of cases have occurred. The first two villages affected with kuru, according to traditional accounts (the order in which the two are placed varies somewhat), were a Keiagana and a Fore village at the Fore-Keiagana boundary. The disease subsequently spread to other Fore villages and thence throughout all

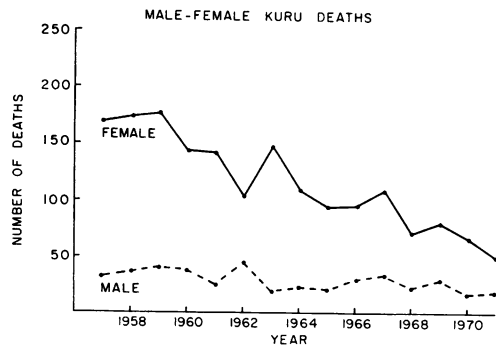


FIG. 2.—Total number of deaths from kuru graphed by year for the first 15 years of intensive kuru surveillance, showing decline in total incidence. Male and female deaths are graphed separately.

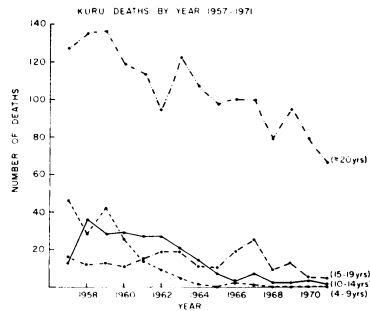


FIG. 3.—Total adult and child mortality from kuru by year for the first 15 years of kuru surveillance, showing disappearance of the disease in the younger age group. Adults are subjects 20 years and older; child deaths represent those patients under 15 years of age; the intervening 15–19 years age group is plotted separately.

Fore clans. Only secondarily did it spread in the other direction into the Keiagana, despite the fact that cannibalism was practiced by both groups.

In general terms, among peripheral groups, the culture and environment are the same as in the center of the region; the only thing which appears to distinguish kuru-free from kuru-affected clans is intermarriage with the Fore. Thus, the delineation of the genetic constitution of kuru patients, of the populations affected by kuru, and of the surrounding kuru-free populations with which they must be compared is still a matter of importance.

Apart from their possible relevance to kuru, the extensive data collected in the course of kuru studies have a much broader significance in the study of human population isolates. It is for this reason, principally, that they are gathered together in the following series of papers. The series is in a sense open-ended, for new studies are being initiated all the time, but at present it is planned to include the following: a survey of blood group genetics [17]; an analysis of the group specific (Gc) component, with special reference to the GcAb in the kuru region of New Guinea [18]; dermatoglyphic studies [19]; a survey of Gm and Inv factors [20]; a study of genetic differentiation between kuru and normal Fore [20a]; a study of genetic structure and heterozygosity in the Eastern Highlands using techniques of genetic distance, genetic networks, bioassay of kinship, and principal components analysis [20b]; a survey of the prevalence of β -amino butyric acid in urine [21]; studies of other red cell factors (including hemoglobins, glucose-6-phosphate dehydrogenase, and soluble malate dehydrogenase) and other serum polymorphisms (transferrins, haptoglobins, and pseudocholinesterases) as well as serum protein levels [22]; and a genealogical study from an area of high kuru incidence in the South Fore region [23]. Once separate analyses for each study have been completed and reported, we plan to combine the results on each individual from all studies and undertake a multivariate analysis [20a, 20b].

POPULATIONS STUDIED

The population in which the surveys have been made are largely from the Eastern Highlands of New Guinea, within and adjacent to the kuru region. However, for

comparison, distant populations in New Guinea and other parts of the world have in some cases been added as well.

The highlands of New Guinea (sometimes rather confusingly called the Central Highlands) form a backbone over 1,000 miles in length along the main axis of the island (fig. 1). The people who inhabit them, whether in West (Indonesian) New Guinea or East (Australian) New Guinea, constitute a broad cultural unit. There is considerable diversity in their culture but no marked discontinuities are found (except for the present alien political one). The East New Guinea Highlands are divided into Southern, Western, and Eastern Highlands. When our genetic surveys were made, the Eastern Highlands (as distinct from the Western Highlands of Australian New Guinea) were coterminous with the administrative district of that name. More recently, the Eastern Highlands have been divided into the Chimbu District and the Eastern Highlands District. Throughout these papers we shall continue to use the term "Eastern Highlands" to mean both these administrative districts. The Eastern Highlands are remarkable in that a large number of small linguistic groups are clustered here (figs. 4-6), in contrast to the larger and more

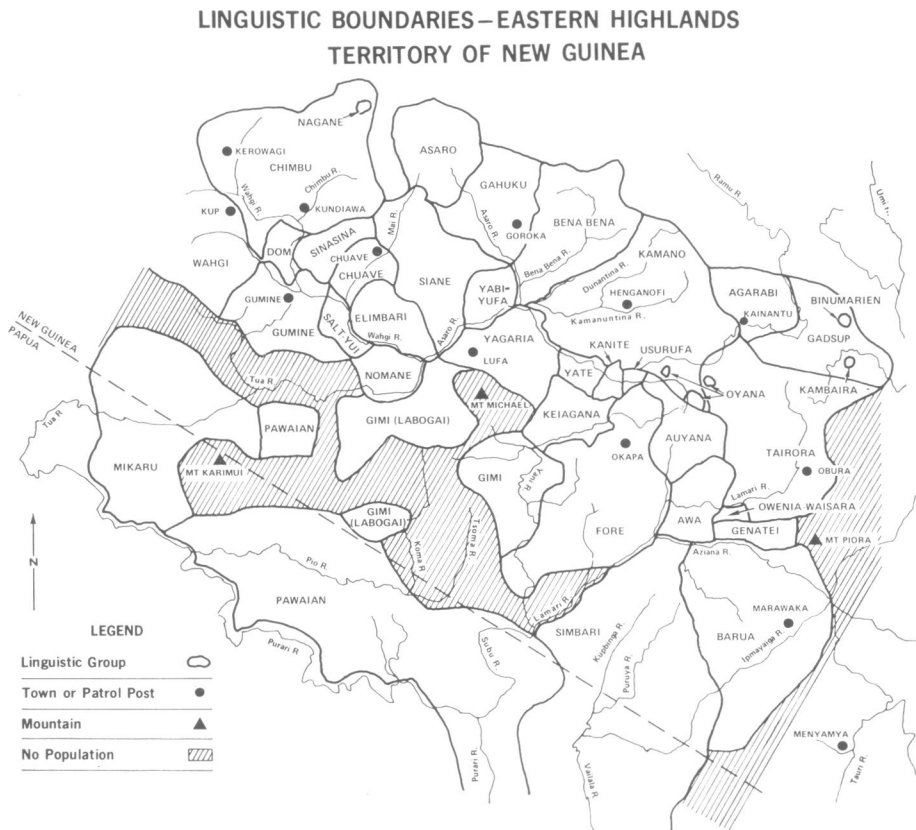


FIG. 4.—The 37 language groups of the Eastern Highlands are shown with respect to the major rivers, principal mountain peaks, and administrative centers.

extensive language groups of the Western Highlands and West New Guinea. Several of these groups number under 1,000 speakers. The distinct, and at times unrelated, languages crowded together in the small area of the Eastern Highlands provide a situation akin to that of island isolates, and this pseudoinsularity is strengthened by the small mating pool associated with each village, even within a large language group.

In studies of the population genetics of primitive human isolates, there is an increasing interest in their genetic heterogeneity, in view of the important role such small isolated groups must have played in the origin of the human species [24–26]. Therefore, we have used these extensive genetic data from numerous isolated villages and hamlets of the Eastern Highlands of New Guinea to investigate the nature and extent of the genetic heterogeneity of their inhabitants with respect to the polymorphic factors studied. These villages or hamlets (in fact, administrative census units which usually correspond to villages or complexes of hamlets) are the smallest functioning sociobiological units of the highland populations; marriages

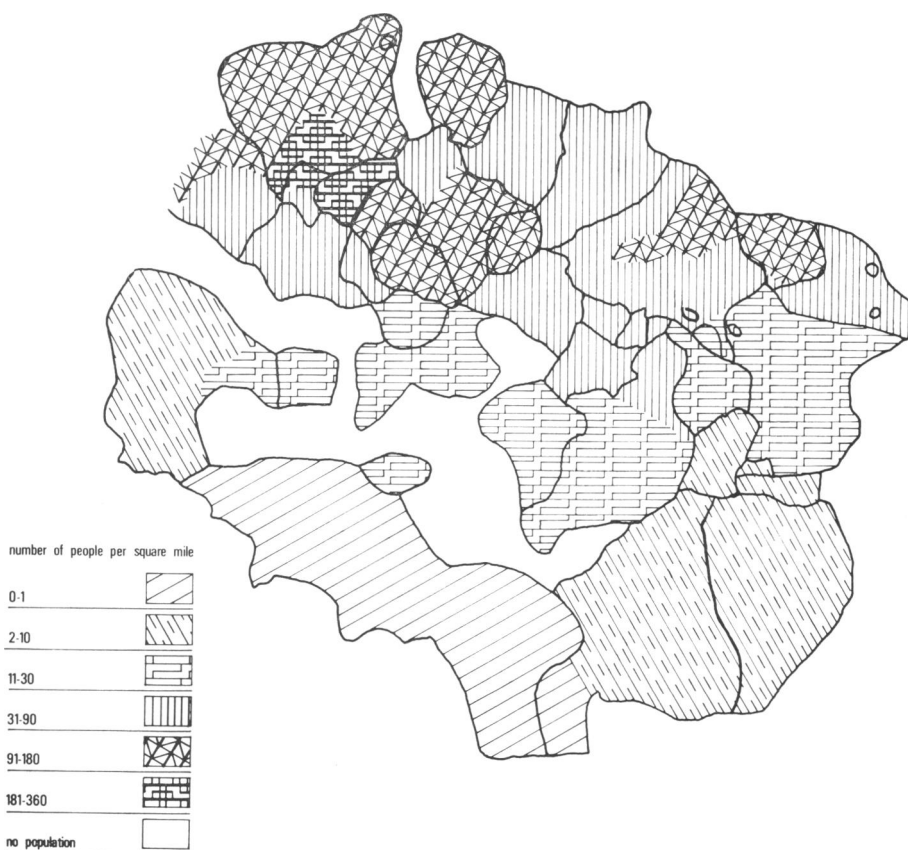


FIG. 5.—Population density within the Eastern Highlands is plotted against the background of the linguistic boundaries.

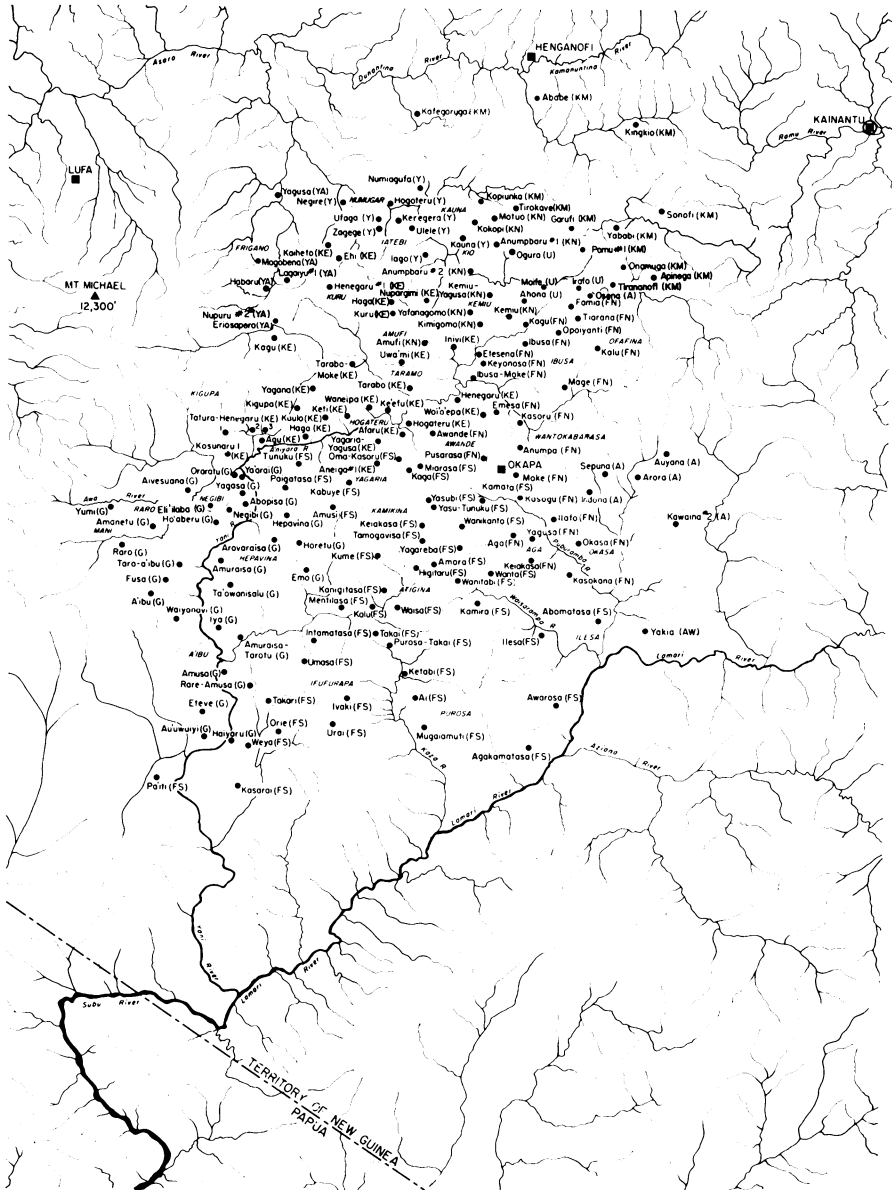


FIG. 6.—The 174 villages (“census units”) which have a history of kuru are located with their linguistic group affiliations indicated: *FS* = South Fore; *FN* = North Fore; *KE* = Keiagana; *G* = Gimi; *A* = Auyana; *YA* = Yagaria; *Y* = Yate; *KN* = Kanite; *KM* = Kamano; *U* = Usurufa; *AW* = Awa. “Tribal” affiliations are shown in italic type.

occur within a small group of such related units. In tabulating and analyzing the data, we have set them out so as to facilitate the search for intergroup and intra-group heterogeneity. Whenever the total number of specimens from a village has exceeded one-quarter of its population, or 25 individuals, the data are tabulated separately by the village in which the subjects reside. In other cases, the results are added only to the total of the appropriate linguistic group.

With population units (villages or clustered hamlets) usually numbering from 100 to 200 individuals, we have tried in the collection of specimens to study a high percentage of individuals rather than attempt random sampling or avoidance of kinsmen, which in these small closed isolates is impossible. Nevertheless, some groups are represented by only a small proportion of their population. This occurred when blood was collected for another purpose or when blood was taken from a group away from its village of origin. In the final analysis, these results have not been discarded, although they are not suitable for any study of heterogeneity. A very careful check of all names was made to combine the results of duplicate bleedings of the same individual at different times; because of our interest in disease and sero-epidemiology, such individuals were numerous.

CULTURAL AND LINGUISTIC GROUPS OF THE EASTERN HIGHLANDS

Throughout the highlands of New Guinea, tribal identity has only been established, as in many other parts of Melanesia, as a result of European contact and administration. Before the establishment of the Australian administration in the region after World War II, the pattern of village life was so restricted that few individuals knew of the extent of their language group; for the large groups, there were no native people who had visited all parts of the region inhabited by those speaking their language. Within such a linguistic group, the people were divided into loose affiliations of "villages" such that each village consisted of a scattered group of hamlets which shifted in location every few years within the region claimed by the village as its domain. Groups of villages, at times extending across linguistic frontiers, were irregularly and loosely affiliated into larger political units with resulting marriage ties, property rights, adoption of children, and frequent exchange of members—again, even across linguistic boundaries—which tended to give some stability to these loose "confederations." They were further stabilized by their relationship to neighboring groups who were regarded either as traditional enemies or as potential, though unreliable, allies. Although at a given time such confederations were discrete, their geographic pattern was complex, and parts of one confederation would often be divided by intervening enemy groups. In fact, separate hamlets of a village might belong, temporarily, if not permanently, to different factions. Once permanent, of course, this would establish the existence of a new "village." The structure of these confederations, or social groupings, was very loose; nowhere in the highlands was there a true tribal organization, formalized tribal leadership, or hereditary chieftainship. If there is anything resembling tribal organization today, it follows from governmental determination of linguistic

boundaries, appointment of village leaders (as *luluai* and *tutul*), conduct of censuses, and administration about a European construct of a "named tribe."

With the advent of Australian administration, the conglomeration of associated hamlets, each of rarely over six houses and located in as many as a dozen different sites (some removed from the others by several miles), has usually been consolidated into a more compact village. The smaller hamlets consisted of the houses of a man and his family, usually along with the houses of one or two friends, with or without their families. Larger hamlets regularly had one or more men's houses separated by several dozen meters from the cluster of women's houses. Men and boys above the age of childhood lived in a separate house from the women, girls, and smaller children; where this type of dwelling was not found (as among the Tudawhe or Pawaian people of Karimui), there was still a separation of sleeping quarters of the men and unmarried youths from the women.

Polygamy was everywhere the rule before mission and government discouraged the practice. It resulted in certain dominant males possessing two, three, or more wives and fathering a disproportionately large part of the next generation, while other men remained unmarried and without offspring. Sexual intercourse, whether between married couples or in irregular liaisons, occurred in the daytime—usually in garden sites, the forest, or elsewhere out-of-doors—and not at night or under a roof although night was frequently used as a convenient cover for arranging sexual liaisons. Attitudes toward adultery varied widely in different linguistic groups. In most groups, it was severely disapproved of and punished; where child "marriage" or betrothal was the rule, almost any irregular sexual liaison could be construed as adulterous. It must be remembered, however, that adultery was much more a violation of property and prestige than of law, and so the practice of different groups varied under a roughly similar "law." In general, it can be said that the consummated marriage bond was highly respected, although in some linguistic groups much more sexual license was condoned, especially among younger people. There was and is everywhere a common and extensive exchange of children in adoption, and voluntary giving of children to relations and friends. While raiding warfare was still the pattern, women and children were at times captured from hostile groups and kept in the community, whereas adult males were usually killed.

As the cultural history of any village is unraveled, repeated splintering or dividing of groups and mergers with fragments from neighboring villages is regularly found. Migrations in and out of villages are still common, and these often occur in groups of several related families. Thus, a village might suddenly lose a portion of its populace after defeat in warfare, increased fear of sorcery, dispute over ground rights or women or other disputes; or a village might suddenly be augmented by the arrival of a large immigrant group seeking refuge. Although such fissions were usually binary, they could involve higher-order fragmentation; the same was true for mergers or fusions.

In any given village there is traditionally a great restriction in the range of villages with which it has contact, both in warfare and in friendly relationships involving marriage and other economic exchanges. Such alliances are restricted

not only to nearby surrounding villages, but often even further limited if some of the neighboring villages are hostile. Thus, the population from which a given hamlet's marriage partners might be drawn is a limited one. These friendly relationships, although restricted, are not confined by language and commonly occur across linguistic boundaries, while long-standing and violently hostile relationships exist between adjacent villages speaking the same language. After a fission in a village or the breakup of an alliance between hamlets, there will continue to be marriage and other payments and exchanges settled between the groups for a generation or two at least. The marriage pool is thus wider than the list of friendly hamlets. This conservative, although not entirely static, nature of the marriage pool is of course important in the development of the genetic background. From the social point of view, the close economic and kinship ties maintained with hostile groups are a major determinant of group conflicts. It is also relevant genetically that local affiliation and residence are more important than strict relations of kinship in determining group membership in most Eastern Highlands societies that have been studied. Thus, recruitment of new individuals into groups is easily achieved.

The culture of the Highland people was neolithic; there were no textiles, grain crops, or metal, and few groups had any pottery. All groups were and are advanced swidden agriculturalists, cultivating a great diversity of food plants in their gardens with hoe and digging-stick. Gardens are fenced to protect them from the ravages of wild and domestic pigs. The major work of the men has always been that of fence building; they also clear the garden sites from the forest. In some areas this is done by cutting and burning trees; elsewhere, by lopping off the top branches to let in the sunlight but letting the trunks stand throughout the gardens. The newly cleared gardens may be repeatedly planted for several years, sometimes for as long as 5-7 years, but eventually they must be left fallow until the forest grows in again. Vast tracts of kunai grass and cane grass (*pitpit*) devoid of trees are characteristic of settled areas of the highlands, and were probably man-made in the past. Gardens made from this land are completely open and cleared. Gardening and nutrition in the kuru region have recently been reviewed by Sorenson and Gajdusek [27] and by Reid and Gajdusek [28]. An occasional discovery of stone mortars and pestles, which have no meaning to any living inhabitant, are evidence of an earlier culture.

The dietary staple of all Eastern Highland groups is the sweet potato (*Ipomoea batatas*). Sugar cane, taro, yams, manioc, banana, winged bean (*Psophocarpus tetragonolobus*), a legume cultivated for its root as well as its fruit, and various greens are found in gardens of all groups. In addition, with missionary and government entry, many new plants have been introduced, including the European potato, corn, peanuts, cabbage, lettuce, beans, peas, etc. There is evidence that the sweet potato was introduced fairly recently [29], and that the previous staple may have been taro or, according to Watson [30], *Pueraria lobata*. As animal husbandmen, the New Guinea highlanders had only the pig, which their women nursed at the breast with the same tender attention they gave their children. Pigs traditionally

shared the house with the women and children and roamed freely through the hamlet. Brookfield [31] has suggested that the diagnostic features of the regional subsistence pattern of the New Guinea highlands are (1) the practice of complete tillage, (2) breeding and stall feeding of pigs in large numbers, and (3) intensive cultivation of sweet potatoes. Watson [32] would like to add the ancient cultivation of *Pueraria lobata*, but this view has not been supported by others [33]. Dogs and fowl were present before direct contact with Europeans, but do not assume much importance in highland cultures; the fowl seems to have been introduced not long before contact, and the dog is of uncertain but more ancient origin.

The diet is everywhere deficient in protein by European standards, and subject to marked seasonal and festive variations. Thus, during pig feasts, meat is plentiful; whereas there may be none for weeks or months thereafter. Pandanus nut in the high rain forest may dominate the diet during some months, as may the fatty juice of the red pandanus when it is ripe in villages at lower altitude. Mushrooms, bush fowl eggs, eels, other wild nuts, edible bamboo, and breadfruit may all suddenly assume major proportions in the diet, only to disappear completely just as suddenly and for long periods. Taro consumption is often seasonal; winged bean and bean root are traditionally eaten in vast quantities when available. Food was prepared without utensils since the people had no pottery, but in recent years tin pots have been introduced everywhere. Traditionally, festive cooking is done with steam produced by pouring water from bamboo cylinders over hot stones in the base of a deep pit, over which have been piled large quantities of vegetables and meat. Standard daily food is prepared over a small housefire, either directly in the hot coals or in bamboo cylinders stoppered to contain the food's moisture.

Cannibalism was traditional in most but not all of the Eastern Highlands populations before Australian administrative control. It consisted primarily of the ceremonial consumption of close-of-kin as an act of respect and as a means of disposal of the dead. Meat and viscera, including brain tissue, were taken from the corpse and cooked in the usual ways, by wrapping in leaves in a steam oven or stuffing into bamboo cylinders. The whole body was eaten, and the meat considered delicate in flavor; the bones were pounded and eaten with greens. The womenfolk especially were enthusiastic cannibals; the men less so, and then only of the meat. Among the Fore people and others who suffered from kuru, the ritual cannibalism and the associated contamination of the women's and children's hands, skin, eyes, nose, and mouth is the probable explanation for the transmission of the kuru agent and for the predilection of the disease for women and children. The women would more often have acquired the agent by direct ingestion at a cannibal feast. Contamination of infants by their mothers is the probable mode of transmission to children, who would eventually come down with the disease in their later childhood after an incubation period of many years.

Since total surveillance of kuru began in 1957, there has been a decline in the number of deaths from the disease, particularly in children and adult women. Over 2,100 deaths occurred in the last 14 years through 1970. Children under 15 years of

age who formerly comprised one-third of all patients, now do not have the disease. This pattern of slowly disappearing kuru is apparently the result of cessation of further dissemination of the virus by the ritual of cannibalism (figs. 2, 3).

The geographic, demographic, anthropological, and medical background of the kuru region and its people has been given in earlier publications [10, 34–39]. A definitive bibliography of kuru, which includes supplements on the social and physical anthropology, linguistics, and natural history of the Eastern Highlands, is regularly published by Gajdusek and Alpers [40]. A valuable general account of the anthropology, ecology, and linguistics of the whole New Guinea Highlands may be found in a special publication of the *American Anthropologist* [41]. The linguistic distribution is of special relevance to our genetic study, and has been analyzed extensively by Wurm [42–44]. There are 37 linguistic groups in the Eastern Highlands varying in size from 150 to 60,000 members, but almost half of them have fewer than 5,000 members. Of all of these groups, only four are not members of Wurm's East New Guinea Highlands linguistic stock, in that they share fewer than 12% recognizable cognates with the members of the stock. All are classified according to the most recent arrangement [44] within the East New Guinea Highlands linguistic phylum (table 1).

Table 1 lists the 37 languages along with their relationships in Wurm's East New Guinea Highlands stock and their populations in 1969. Two of the five families of the stock are found almost entirely in the Eastern Highlands. The third spans the Eastern and Western Highlands of Australian-administered New Guinea and the other two families are in the Western and Southern Highlands. In addition, there are a small number of languages on the periphery which belong to the East New Guinea Highlands linguistic phylum, but not to the stock. In the Eastern Highlands, Mikaru (Daribi) and Pawaian (Yar, Tudawhe) fall into this category, as well as the Barua and Simbari languages of the Anga stock [46].

It is of interest that this linguistic diversity exceeds that of the Central, Western, or Southern Highlands; west of the Strickland Gorge, the Ok family of languages extending through the Star Mountains into West New Guinea forms a group of languages around the Sepik headwaters which are large in the number of speakers and the areas which they cover. Westward, the Dani, Western Dani, Moni, Uhunduni, Dem, and Dauwa comprise large linguistic groups of many thousands, sometimes tens of thousands, of speakers which extend to the Ekagi (Kapauku) of the Wissel Lakes. These groups, but not the Ekagi, appear again to be distantly related to the languages of Wurm's East New Guinea Highlands stock, which thus forms one huge group of related languages across the highland spine of the island.

This is an oversimplified, but we hope useful, overview of the highland peoples. The linguistic picture is paralleled by the general pattern of large elaborate societies with more highly developed political systems and leadership, and wider economic and political ties between villages in the Center and West, than in the more linguistically fragmented East.

TABLE 1
LANGUAGES* OF THE EASTERN HIGHLANDS† OF NEW GUINEA

Family and Subfamily	Language and Dialect	Population 1969
Languages of the East New Guinea Highlands Stock		
Eastern (Gadsup-Auyana-Awa-Tairora):		
Gadsup-Oyana	Gadsup	9,100
	Akuna	
	Tompena	
	Agarabi	10,500
	Oyana	1,300
	Uteia	
	Oiyana	
	Ontenu	
Auyana-Usurufa	Auyana	5,200
	Asempa	
	Kawaina	
	Kosena	
	Usurufa	1,300
Awa	Awa	1,200
	Mobuta	
	Elakia	
	Tauna	
Tairora-Binumarien	Tairora	12,200
	Pinata-Kobonbira-	
	Oraura	
	Abiera	
	Batainabura	
	Baira	
	Owenia-Waisara	350
	Kambaira	c. 150
	Binumarien	c. 150
Waffa‡ .....	...	...
East-central (Gende-Siane-Gahuku-Kamano-Fore):		
Gende-Biyom‡ .....	...	...
Siane	Siane	c. 16,000
	Yabiyufa	c. 5,000
Gahuku-Bena Bena	Gahuku	c. 11,500
	Asaro	c. 12,000
	Bena Bena	c. 12,300
Kamano-Yagaria-Keiagana	Kamano	41,800
	Yagaria	19,100
	Keiagana	11,000
	Kanite	3,200
	Yate	2,500
Fore-Gimi	Fore	15,100
	Gimi	20,100
	Genatei	500
Central (Hagen-Wahgi-Jimi-Chimbu):§		
Wahgi	Wahgi ||	c. 10,000#
Chimbu-Chuave	Chimbu (Kuman)	c. 62,000
	Nagane	c. 500
	Dom	c. 15,000

TABLE 1 (*Continued*)

Family and Subfamily	Language and Dialect	Population 1969
Chimbu-Chuave (<i>cont.</i>)	Gumine	27,500
	Yuri	8,500
	Golin	8,500
	Mian	2,500
	Keri	4,000
	Kia	4,000
	Salt-Yui	c. 5,000
	Yui	
	Sinasina	c. 16,000
	Chuave	c. 25,000
	Elimbari (Sua)	c. 9,500
	Nomane	c. 2,600
	Nomane	c. 2,000
Kiari	600	
Languages of the Anga Stock		
	Barua	4,400
	Barua	2,800
	Imani	300
	Wantekia	1,300
	Simbari	1,900
Stock-Level Isolates		
	Mikaru (Daribi)	2,600
	Pawaian (Yar, Tudawhe)	3,100

* All languages of the Eastern Highlands belong to the East New Guinea Highlands phylum of the group of languages called Papuan, non-Melanesian, or non-Austronesian [43, 44].

† For convenience, we regard the Eastern Highlands as coterminous with the present Eastern Highlands and Chimbu administrative districts.

‡ An extension of a language family outside the Eastern Highlands. The Waffa language is spoken by people living in the Morobe District adjacent to the Eastern Highlands. Both the Gende and Biyom languages are found in the Madang District beyond the northern ranges of the Eastern Highlands.

§ The Hagen and Jimi subfamilies are found in the Western Highlands.

|| An extension of a language into the Eastern Highlands. Only one of the five dialects of Wahgi is found in the Eastern Highlands as we have defined it. In Wurm's usage, this small area is included in his Western Highlands. Linguistically, this makes sense, but as the area is administered within the Chimbu District we have included it in the Eastern Highlands. This particular dialect is called Kup-Minj by Wurm [43] and Kumai by Deibler and Trefry [45].

Only that portion of the population within the Eastern Highlands.

SUMMARY OF POPULATIONS STUDIED

In table 2 are tabulated only those linguistic groups which appear in the genetic survey we have undertaken, with further information on their demography and the number of census units where kuru has been found. Their geographical relationship to each other and their relative population densities are found in the maps of figures 4-7. What follows are brief sketches with particular information about these 20 pertinent linguistic groups.

TABLE 2
SUMMARY OF POPULATIONS STUDIED

Linguistic Group	Popu- lation (1958)	Popu- lation (1969)	Area (sq mi.)	Density of Popu- lation	Census Units	Number of			Adminis- trative Center	Language Group (Wurm)	Others in Sub- family	Contiguous Groups (N.E.S.W.)
						Tribal Groups	Dialects	Division				
Fore North	5,029	6,924	121	57.2	23	6	1	North Fore
Fore South	6,962	8,145	275	29.6	42	5	2	South Fore
Total Fore	11,991	15,069	396	38.1	65	11	3	Okapa	Fore-Gimi S/F; east-central F	Gimi, Genatei	Kanite, Usurufa, Kamano, Auyana, Awa, Simbari, Pawaian, Gimi, Yagaria, Keiagana	
Gimi	7,418	10,002	430	23.3	40	4	1	Okapa
Labogai Gimi	7,422	10,059	560	18.0	64	...	2	Labogai, Unavi
Total Gimi	14,840	20,061	990	20.3	104	...	3	...	Fore-Gimi S/F; east-central F	Fore, Genatei	Nomane, Elimbari, Siane, Yagaria, Keiagana, Fore, Pawaian	
Keiagana*	10,000	10,989	235	46.8	36	5	1	Okapa	Kamano-Yagaria-Keiagana S/F; east-central F	Kamano, Yagaria, Kanite, Yate	Yagaria, Yate, Kanite, Fore, Gimi	
Kanite	2,584	3,176	90	35.3	9	3	1	Okapa	Kamano-Yagaria-Keiagana S/F; east-central F	Kamano, Yagaria, Keiagana, Yate	Kamano, Usurufa, Fore, Keiagana, Yate	
Yate	2,474	2,482	85	29.2	10	3	1	Henganofi	Kamano-Yagaria-Keiagana S/F; east-central F	Kamano, Yagaria, Keiagana, Kanite	Yagaria, Kamano, Kanite, Keiagana	
Yagaria	14,720	19,050	268	71.1	80	6	6	Lufa	Kamano-Yagaria-Keiagana S/F; east-central F	Kamano, Yagaria, Keiagana, Kanite, Yate	Yabiyufa, Bena Bena, Kamano, Yate, Keiagana, Gimi, Elimbari, Siane	

Linguistic Group	Population (1958)	Population (1969)	Area of Population (sq mi.)	Density of Population	Census Units	Number of		Administrative Center	Language Group (Wurm)	Others in Sub-family	Contiguous Groups (N.E.S.W.)
						Tribal Groups	Number of Dialects				
Kamano	30,609	41,829	492	85.0	163 (16)	3	Dunantina	Henganofi	Kamano-Yagaria-	Yagaria,	Agarabi, Tairora,
							Kafe	Henganofi	Kaigana S/F;	Keigana,	Oyana, Auyana, Usurufa,
							Fayantina	Henganofi	east-central F	Kanite,	Kanite, Yate, Yagaria,
							Kamano	Kainantu		Yate	Bena Bena
Auyana	3,847	5,201	205	25.4	15 (6)	3	Auyana	Okapa (since 1964)	Auyana-Usurufa S/F; eastern F	Usurufa	Kamano, Oyana, Tairora, Awa, Fore, Usurufa
Usurufa	849	1,306	25	52.2	4 (4)	1	Kamano	Kainantu	Auyana-Usurufa S/F; eastern F	Auyana	Kamano, Oyana, Auyana, Fore, Kanite
Awa	974	1,175	120	9.8	8 (1)	3	Piora	Obura	Awa S/F;	...	Auyana, Tairora, Genatei, Owenia-Waisara, Barua, Simbari, Fore
Agarabi	8,232	10,482	107	98.0	31 (0)	1	Agarabi	Kainantu	Gadsup-Oyana S/F; eastern F	Gadsup, Oyana	Gadsup, Tairora, Kamano
Gadsup	6,224	9,087	115	79.0	23 (0)	2	Gadsup	Kainantu	Gadsup-Oyana S/F; eastern F	Agarabi, Oyana	[Amari], [Atsera], Binumarien, Kambaira, Tairora, Agarabi
Oyana	931	1,328	40	33.2	5 (0)	3	Kamano	Kainantu	Gadsup-Oyana S/F; eastern F	Agarabi	Kamano, Tairora, Auyana, Usurufa
Tairora:							Tairora	Kainantu		Gadsup,	
Pinata-Kokonbira-											
Oraura group	...	727	40	18.2	4	1	Piora	Obura	...	...	...
Other	...	11,468	490	23.4	46	3	Tairora	Kainantu	...	...	...
							Iturua	Kainantu			
							Dogara	Obura			
Total Tairora	8,181	12,195	530	23.0	50 (0)	4	...	...	Tairora-Binumarien S/F; eastern F	Binumarien, Kambaira, Owenia-Waisara	Kamano, Agarabi, Gadsup, [Atsera], [Banir], Genatei, Owenia-Waisara, Awa, Auyana, Oyana

TABLE 2 (Continued)

Linguistic Group	Popu-lation (1958)	Popu-lation (1969)	Area (sq mi.)	Density of Pop-ulation	Census Units	Number of Tribal Groups	Number of Dialects	Census Division	Adminis-trative Center	Language Group (Wurm)	Others in Sub-family	Contiguous Groups (N.E.S.W.)
Owenia-Waisara	...	333	40	8.3	(0)	...	1	Flora	Obura	Tairora-Binumarien S/F; eastern F	Tairora, Binumarien, Kambaira	Tairora, Genatei, Awa
Genatei	...	524	140	3.7	(0)	3	1	Aziana	Marawaka	Fore-Gimi S/F; east-central F	Fore, Gimi	Tairora, Owenia-Waisara, Barua, Awa
Gumine	...	27,508	479	57.4	(0)	120	5	Wikauma Marigi Salt	Gumine Gumine Gumine	Chimbu-Chuave S/F; central F	Chimbu (Kuman), Sinasina, Nagane, Dom, Salt-Yui, Chuave, Elimbari (Sua), Nomane	Chimbu, Dom, Sinasina, Chuave, Salt-Yui, Nomane, Pawaian, Mikaru, Wahgi
Barua	...	4,380	690	6.3	(0)	38	9	Wugamwa Aziana Marawaka	Marawaka Marawaka Marawaka	Anga stock	...	Awa, Genatei, [Yagwoia], Simbari
Simbari	...	1,938	327	5.9	(0)	29	8	Kuwepu Marawaka	Marawaka Marawaka	Anga stock	...	Fore, Awa, Barua, Pawaian
Pawaian (Yar) (Tudawhe)	...	3,088	980	3.2	(0)	17	2	Pio Tura Karimui	Karimui Karimui Karimui	Pawaian stock	...	Gumine, Gimi, Mikaru, Fore, Simbari

NOTE.—Numbers in parentheses are number of census units with kurt; groups in brackets are those outside East New Guinea Highlands; S/F= subfamily; F = family.
 * Included in the Keiagana linguistic group are three census units of Yagaria people numbering 617 in 1969.

GROUPS BELONGING TO THE EAST NEW GUINEA HIGHLANDS LINGUISTIC STOCK

Fore

The Fore comprise a linguistic and cultural group of some 15,000 persons in the Eastern Highlands of Australian New Guinea. Their villages and hamlets are located at elevations of 3,000–8,000 feet on the forested slopes and hillsides of a steeply mountainous area lying between the Yani and Lamari Rivers. These rivers join in the uninhabited forest south of the Fore to form the Subu, which flows into the Purari River and the Gulf of Papua. (The Subu is erroneously called the Aure, a Simbari language name for an upper tributary of the Vaiala—on some maps of Papua). The valleys of their homeland are narrower and less extensively covered with kunai grass than the broad unforested floors of the more central highlands.

For administrative purposes, the Fore are divided into two groups, North and South. The administrative boundary does in fact coincide with a minor linguistic and cultural division. In the 1969 census the population of the North Fore was 6,924 and the South Fore was 8,145. The population density is 57 persons per square mile in the North, 30 in the South. This difference reflects the greater separation of village communities in the South Fore, especially at the southern edge of the group where the area merges imperceptibly with the vast uninhabited rain forest extending into the lowlands of the Papuan Gulf; the only intervening people are scattered groups of Pawaiians of the Yar or Iare subgroup. Between 1945 and 1950 certain South Fore communities broke away from their own groups and moved into this malaria-infested forest, but they had all perished or returned by 1955.

The Fore may have first heard of white men in 1930 when Leahy and Dwyer came through the Eastern Highlands and down the Purari River into Papua. In 1934 the Ashtons, and in 1936 Ted Ubank, entered the North Fore region looking for gold. Other prospectors followed in the late 1930s. During World War II a party of downed airmen ascended the Lamari from the South Fore region to Kainantu, and a fleeing group of civilians descended along the Lamari to Papua. The first government patrol into the North Fore was in 1947, but the Okapa patrol post was not set up until 1955. The North Fore was declared “de-restricted” in 1951; and the South Fore in 1958. Early missionary activities included native evangelists from the Lutheran mission stations of Raipinka (into the North Fore at the time of the first patrols) and Tarabo (established in 1949), Seventh-Day Adventist evangelists from 1956, and the World Mission at Purosa in the South Fore from 1958.

The census units for the whole Okapa subdistrict were reorganized in 1957 at the time of the first kuru epidemiological patrols and have not needed to be changed since. The ten linguistic groups surrounding the Fore people (Kanite, Usurufa, Kamano, Auyana, Awa, Simbari, Pawaiian, Gimi, Yagaria, and Keiagana) are clearly differentiated from them by language, although many villages bordering on the Fore region are bilingual, at least among their males. The Fore, however, do not all speak exactly the same language. There are three distinct dialects which we have tended to call the Moke, Atigina, and Purosa dialects of Fore, but which Scott in his analysis of them has called Northern, Central, and Southern Fore, respectively [47]. The central and southern dialects are called by their speakers *atikamana* and *pamusakamana*, respectively, but neither speakers nor outsiders seem to have devised a commonly accepted name for the northern dialect. The southern dialect is different more from the other two than they are from each other, especially when vocabulary and affixal differences are considered in addition to straight cognate counts. However, there is a high degree of mutual intelligibility between the dialects, and a very much closer relationship between them than between Fore and any of the surrounding languages (89% cognates at the minimum compared with 46% between Fore and its closest relative, Gimi).

The name “Fore” has been misapplied to the people by European missionaries and administrators, medical workers, and anthropologists, but they have now accepted it in the

same way that they have accepted the arbitrarily named census units set up by the administration as their own villages. Actually, *Pore kina* refers in their language to the people of the Fore villages of Abomatasa, Ilesa, and Awarosa, and all the Awa linguistic group villages between the Lamari and Aziana Rivers: Mobutasa, Agamusei, Amoraba, Tainoraba, and Kairaba. This designation spans a very sharp Fore-Awa linguistic and cultural boundary. The Awa too accept this use of "Pore." Before they were all given the same name, the Fore themselves referred to other groups of Fore as *Yanarasa kina*, *Pamusa kina*, *Asa kina*, *Ati kina*, etc. *Yanua kina* or *Mania kina* was used for the Gimi linguistic groups to the west, *Keia kina* for the Keiagana-speaking people to the northwest, and *Koka kina* for the Auyana to the east. The Anga, or Kukukuku people, bordering them on the southeast, were called the *Moraie kina*, from which came the use of the term "Moraie" for the southwesternmost group of Simbari languages known now to the government as "Dunkwi."

Fore culture has been extensively studied by many of the workers on the kuru research problem over the past decade, and two anthropological couples have worked in the area. Catherine and Ronald Berndt worked in Kagu near the Fore-Usurufa border in the North Fore from November 1951 to April 1952, and visited Moke (or Okapa) where the patrol post is today, and nearby Pusarasa between November 1952 and March 1953 [34, 48-50]. Shirley and Robert Glasse, who lived at Wanitabe in the South Fore in 1961-1963, studied anthropological factors associated with kuru as well as the ethnography of the South Fore region [35, 36, 51-54]. The language has been studied by the Summer Institute of Linguistics [47, 55, 56]. Literacy materials have been prepared in Northern Fore by G. K. Scott, and in Southern Fore by Mildred Cervinka of the World Mission.

Of over 2,100 deaths from kuru recorded since the beginning of 1957, 83% have occurred among the Fore.

Gimi

The Gimi are a group of 20,100 people living in the forested southwestern corner of the Eastern Highlands District just north of the Papuan border, bounded on the east by the South Fore, and on the north, from west to east, by the Nomane, Elimbari, Siane, Yagarua, and Keiagana. They straddle the southern spur of Mount Michael: those to the east of this 2,700-m divide, on the Yani River watershed, are in the Gimi census division of the Okapa subdistrict, while those on the western side are on the Tua River watershed, and are censused in the Labogai and Unavi census divisions of the Lufa subdistrict. To the south of them, across the ranges that separate them from the Karimui Plateau, are the much-feared Pawaian people with whom they have some trade contacts and marriage ties, and from whom they probably imported leprosy which was moderately prevalent at the time of first Australian contact. The Gimi population is quite thinly spread out, with a density of 20 per square mile. At times, groups of Fore, Keiagana, and Yagarua have fled their homelands to settle among the Gimi, and some have remained.

Most Gimi had no contact with white men until 1948 or 1949 when government exploratory patrols crossed their area. The first census in the area was made in 1950. Lufa and Okapa, the patrol posts from which the Gimi people are administered, were established in 1954 and 1955, respectively. The Gimi were not brought fully under government administrative control until the late 1950s.

The Gono mission was established by American Protestants southwest of Lufa in 1954; the New Tribes mission moved into the Yani River Gimi area in 1957; and in 1959 the Lutheran mission was established on the Lufa side at Agotu. Seventh-Day Adventist missionaries are also working among the Gimi.

The Gimi have been slower to change their traditional ways than their closely related neighbors, the Fore and Keiagana. They accepted the new ideas of the administration, such as the appointment of village headmen and the growing of coffee, but did not immediately discard their old modes of dress or housing, or the practice of cannibalism.

Neither linguistically nor culturally have they been much studied, though medical patrols have frequently been through the area looking for kuru patients. Glick has studied their ethnozoology and native medicine [57]. S. H. McBride of the Summer Institute of Linguistics is now working among the Yani valley Gimi. As a language, Gimi is closely related to Fore (46% cognates in Wurm's analysis). Culturally also, there are close relations with the Fore, and adjacent villages have marriage and social ties across the linguistic boundary.

Of the 40 villages of Yani River Gimi, 28 have had sporadic cases of kuru, usually traced to immigration and marriage exchange from the Fore. The Tua River Gimi (Labogai) have no kuru.

Keiagana

The Keiagana are a group of 11,000 people surrounded by the Yagaria, Yate, Fore, Kanite, and Gimi linguistic groups. Most of them are administered from the Okapa patrol post and censused with the Kanite linguistic group. The northernmost group is in the Fayantina census division of the Henganofi subdistrict. There are five "tribal" or native groups in the Keiagana, the largest of which is Tarabo (or Taramo); it was among this group that the Lutherans set up their mission in 1949 and built an airstrip. Tarabo was selected first as the site for the government patrol post for the area, and early patrols based from Goroka came into the kuru region from here; the patrol post was eventually built at Moke in the North Fore, and called Okapa. The airstrip at Tarabo is still the only one in the subdistrict.

The Keiagana have 36 villages fairly evenly spaced over their area, with a population density of 47 persons per square mile. Three of these villages are of an immigrant Yagaria group. Today these people are regarded by the government entirely as Keiagana, and they themselves are likely to deny any knowledge of their original language and culture. Of the three immigrant villages, only two have been subject to kuru, and have had an incidence considerably higher than that obtaining among the rest of the Keiagana. These immigrants live in a pocket extending deeply into the North Fore, and have close relationships with neighboring Fore groups, as well as with other pockets of Yagaria people settled among the North Fore.

The Keiagana language is classified in one family with Kamano, Yagaria, Kanite, and Yate. Together with the last three, it forms a very closely connected group of languages and people. When studied by the Berndts in 1951-1952, this whole group was called the Jate, among whom the Taramo Keiagana were distinguished as Ke'zjagana or Keijagana Jate [48]. Although they are the central group of the kuru region, neither their language nor culture has been intensively studied.

The stories of the origin of kuru from many informants suggest that the first case occurred among the Keiagana people at Uwami, but the Keiagana people insist that it came originally from the Fore and that their first knowledge of it was at Awande, the North Fore village adjacent to both the South Fore and the Keiagana, from where it spread to Uwami. In any case, it is clear that kuru has affected the Keiagana people from the beginning, though its incidence among the Keiagana is low compared with the South Fore. Of the 36 Keiagana villages, 29 have a history of kuru and are considered part of the kuru region; in the last 2 years cases have occurred in only eight of them.

Kanite

The Kanite are a small group of 3,200 people living in nine villages in a small mountainous area in the north of the Okapa subdistrict. They form a single census division with the Keiagana, but are most closely related to the Yate people to the northwest of them, in the Henganofi subdistrict. The two languages, Kanite and Yate, are probably best regarded as dialects of a single language in the Kamano-Yagaria-Keiagana subfamily. The distinction between the two is more a matter of political and clan affiliation—and more

recently, of administrative differences—than of linguistic separation. The phenomenon of those villages called Kanite being administered from Okapa and those designated as Yate being administered from the Henganofi patrol post in the early 1950s led to the establishment of two census divisions and the strengthening of the distinction between the groups.

The first patrols came into the region in the late 1940s from Kainantu, followed soon after by evangelists from the Lutheran mission in Raipinka. In 1951–1952 Catherine and Ronald Berndt studied certain Kanite groups during their stay in the neighboring North Fore: they grouped them with Yagaria, Keiagana, and Yate as the Jate, the Kanite being specified as Kemiyu Jate. The Kanite language has been studied by Gwen Gibson and Joy McCarthy of the Summer Institute of Linguistics, and a number of literacy texts, as well as a linguistic analysis have been produced.

Kuru has occurred in all nine Kanite villages, but it has been sporadic. Although the incidence of the disease has never been high, Kanite is the only linguistic group outside the Fore where the whole population contributes to the kuru region. In the last 2 years there have been only four cases of kuru, involving three villages.

Yate

The Yate are a small, rather poorly defined group of about 2,500 people, who live in the northwestern part of the kuru region just beyond the boundary of the Okapa sub-district. Their group comprises 10 villages, which are censused from Henganofi in the Fayantina census division (which they share with two Yagaria, nine Keiagana, and 31 Kamano villages).

Their language is very closely related to Kanite and falls into the Kamano-Yagaria-Keiagana subfamily of the Gende-Siane-Gahuku-Kamano-Fore (east-central) family in Wurm's classification. Kanite and Yate are classed here as separate languages, but are probably more accurately described as dialects of a single language. The Yate are the central group of this linguistic subfamily and have no other neighbors. To the east they are clearly separated from their closest relations, the Kanite, by an administrative boundary; to the west there is no such imposed boundary and they merge with their more distant relations, the Yagaria; to the north are the Kamano, and to the south, Keiagana.

Their area was first opened up by administration patrols from Goroka and Kainantu in the late 1940s. The Jate studied by the Berndts in 1951–1952 encompassed the whole linguistic subfamily apart from the Kamano; the present-day Yate were not separately specified by them but might be included in either the Kemiju Jate (Kanite) or Friganu Jate (Yagaria) [34].

The Yate have not been separately studied by either anthropologists or linguists. Of the 10 villages, nine have at some time suffered from kuru and therefore fall into the kuru region. In none of them, however, has the prevalence ever been more than one or two cases; only 15 cases have been recorded in all, and there have been three since 1960.

Yagaria

The Yagaria are a group of 19,000 people whose 80 villages, situated north and west of the Mount Michael massif, are mainly in the Yagaria census division of the Lufa subdistrict but who spill over westward into the Labogai census division and eastward into the Fayantina division of the Henganofi subdistrict. They have in the past spread further; a pocket of three villages in the Keiagana linguistic group (Aneiga 1 and 2, and Yagaria Yagusa) are Yagaria immigrants, and hamlets of the Aga group of Northern Fore people (including the villages of Aga Yagusa and Yagusa) have close Yagaria relations, although they are 2 days' walk from the main body of Yagaria people.

The name they are now known by derives from people to their north, for they had no collective name either for their language or themselves [58]. Their language belongs to

the Kamano-Yagaria-Keiagana subfamily of the Gende-Siane-Gahuku-Kamano-Fore (east-central) family in Wurm's classification, and they form a geographic and cultural, as well as linguistic, link between the Gahuku-Bena Bena peoples of the wide Goroka valley and the more fragmented Keiagana-Fore peoples living in deeply dissected mountain ranges to the south. The linguistic groups directly adjacent to the Yagaria are from the north, proceeding in a clockwise direction, Yabiyufa, Bena Bena, Kamano, Yate, Keiagana, Gimi, Elimbari, and Siane. There are six native divisions and dialects of Yagaria, of which the most important is Frigano. The Berndts make some mention of their culture, as found in 1951-1952, under the name of Friganu Jate [34].

No intensive anthropological or linguistic work has been done among the Yagaria. The language has been studied by Renck [58], who speaks the Frigano dialect. Yagaria has an interesting relationship with other members of the linguistic subfamily, in that it is more complex morphologically and has segments of higher phonetic rank than either Keiagana, Kanite, or Yate. This leads to a one-way intelligibility: Yagaria-speakers have little difficulty in understanding Keiagana, Kanite, or Yate, but the others find Yagaria incomprehensible [42]. It is the most complex ("primitive") and undegenerate language of the linguistic family.

Seven of their villages have in the past and in recent years suffered from kuru, including the village of Yagusa, but fewer than 10 cases have been recorded in all.

Kamano

The Kamano are a large group of 42,000 people living in 163 villages in the south-western portion of the Kainantu subdistrict and over most of the Henganofi subdistrict of the Eastern Highlands. They border the Okapa subdistrict to its north.

The Kamano speak a language belonging to the Gende-Siane-Gahuku-Kamano-Fore (east-central) family of Wurm's East New Guinea Highlands stock. It is closely related to the Kanite, Yate, and Keiagana languages of the kuru region. There are no great differences in housing styles, dress, gardening practices, and other aspects of the social and cultural order between the Kamano and their immediate neighbors, especially the Yate, Kanite, Usurufa, Oyana, and Auyana to their south. The Yagaria-speaking people border the Kamano to the southwest and the Bena Bena people to the northwest. To the east, Agarabi and Tairora meet Kamano at the government administration center of Kainantu.

The Kamano have a longer history of contact with the white man than most other groups in our study. In 1917-1918 Capt. Herman Detzner, hiding in the bush from Australian patrols, may have entered the headwaters of the Markham and met them. In 1926 native catechists from Finschhafen began to teach in the valleys of the Ramu-Purari headwaters. The prospector Ned Rowlands first entered the Kainantu area in 1929 and found gold in the upper Ramu valley. This encouraged Michael Leahy and Michael Dwyer in 1930 to cross the Ramu divide and enter the highlands, which they finally left by going down the rivers past Mount Michael to the Papuan coast. A patrol post was established at Kainantu in 1932. One year the first Lutheran mission was established in the Eastern Highlands. Miners and prospectors continued to work out from Kainantu: in 1934 the Ashtons entered the kuru region and from 1936 Ted Ubank (who had been in the Kainantu area since 1929) spent some time working in the region. During World War II a miner and a number of downed airmen walked south through the Eastern Highlands to the Papuan coast. At the end of the war, administration patrols began again from Kainantu.

The Kamano occupy a large area extending westward from Kainantu further into the highlands and southward toward Okapa to the Ramu-Purari divide where the Usurufa separate them from the Fore. It is quite clear that during the early exploratory efforts recounted here, meaningful contacts were made with the Kamano people. However, until World War II the administrative control established over the people had been fairly super-

ficial, and this was disrupted by the exigencies of the war. Early after the war, McGregor, patrolling south from Kainantu, was attacked by still uncontrolled Kamano in the Sonofi limestone caves. Other patrols, led by Skinner, were attacked around Kainantu itself. It was only in the late 1940s that full administrative control of the Kamano region was achieved.

Although the Kamano were among the earliest Eastern Highlands people to have contact with missionaries, miners, and government officials, not much has been written about them. Fortune studied the northern Kamano in 1935 [59]. Rev. Johannes Flierl, who established the Lutheran mission among the Kamano at Raipinka and Onerunka, studied their culture and Rev. A. Frerichs from Raipinka worked on their language. The southern Kamano (or Kafe) language and culture were studied by the Berndts in 1951–1952 from their base in the North Fore [48, 60]. They reported on a mass hysterical tremor syndrome associated with a cargo cult which swept through Kamano villages in the early 1950s. More recently, Seventh-Day Adventist and other missions have moved into the area. Linguistic analysis is being continued by a team from the Summer Institute of Linguistics (Dorothy Drew and Audrey Payne), who have prepared literacy texts and a preliminary grammar.

The Kamano are virtually free of kuru; sporadic cases have occurred in 16 of their many villages, mostly in Yababi, Onamuga, Garufi, Sonofi, and Tirokave. The first two are villages which have had extensive settlement of immigrants from the kuru region; those arriving at Yababi came from the Hogateru region of the Keiagana linguistic group, and those arriving at Onamuga from the Moke region of the Fore. Some intermarriage with the Fore and Keiagana continues in these two groups.

Auyana

The Auyana are a group of 5,200 people living in 15 villages who occupy an irregular area of about 200 sq miles southeast of a direct line from Kainantu to Okapa. Until 1964 they were censused from Kainantu, but their administrative center is now Okapa. There is a road through their territory from Okapa to Kainantu which was completed in 1965, but it is rarely used as a direct route, so the Auyana people still remain relatively isolated.

Their area was patrolled from Kainantu in the early 1950s; the first censuses took place in 1953 in the Lamari census division. Only later did Auyana villages become incorporated in their own census division, which includes two Awa villages as well. One Auyana village, Kosena, is still censused from Kainantu in the Kamano census division as Irafo no. 2. The people have been served since 1963 by the Lutheran mission, both from a station established in 1960 at Ponampa, in their own territory, and from Awande Hospital in the North Fore.

The Auyana are bordered by the Usurufa, Kamano, and Oyana to the north, Tairora to the east, Awa to the south, and Fore to the west. With Usurufa, their language forms a subfamily in the Gadsup-Auyana-Awa-Tairora (eastern) family of the East New Guinea Highlands stock. In Wurm's analysis, there are two distinct dialects of Auyana—Auyana proper and Kosena—the language spoken in the Kosena (Oseno) district of the Auyana panhandle close to Usurufa. McKaughan [61] divides the "Auyana proper" into Asempan and Kawaina dialects, making three in all; he also regards Usurufa as essentially another dialect of Auyana. The Kosena dialect is being studied in detail by a member of the Summer Institute of Linguistics (Doreen Marks), who has produced literacy texts and a dictionary [62].

Only six of the 15 Auyana villages have had experience of kuru, but with only a few cases in each instance.

Usurufa

There are only four Usurufa-speaking villages, Ahona (Orona; Kagu), Irafo (Ilafo), Moife, and Ogura (Agura), with a total population of 1,300, censused and administered together with the Kamano people in the Kainantu subdistrict. Their villages occupy the

watershed between the Ramu and Purari River drainages, with the villages of Ilafo and Moife high on the dividing ridge. The area was first patrolled in 1947 and declared "de-restricted" by the administration in 1949. Its early history of contact is essentially the same as that of the North Fore (see above).

The Usurufa language belongs to the Gadsup-Auyana-Awa-Tairora (eastern) family of the East New Guinea Highlands stock, and it is most closely related to Auyana. Wurm places it in a separate subfamily with Auyana, whereas McKaughan [61] regards it as a dialect of Auyana. With Kanite, Oyana, Fore, Auyana, and Kamano neighbors surrounding their small territory, the Usurufa adults are usually bi- or tri-lingual. As might be expected from their geographic proximity, those in the northern village of Ilafo, with maximal contact with the Kamano, tend to speak Kamano, while those in the southernmost village of Orona speak Fore.

The anthropologists Ronald and Catherine Berndt in 1951-1952 lived in the Usurufa village of Orona adjacent to the North Fore village of Kagu (also known as Orona-Kagu and called by them Kogu) for 6 months while they were studying the Usurufa, North Fore, Kanite, Yate, and Kamano peoples [34]. Catherine Berndt [48] made a special study of their languages, in particular Uturupa (Usurufa), Kafe (Kamano), and Fore. The team of Darlene Bee and Kathleen Barker, from the Summer Institute of Linguistics, moved into the Usurufa village of Orona in 1960, shortly after the institute came to New Guinea, and have worked there almost continually since then [63, 64]. They refer to the language as Usarufa, and have produced a dictionary, grammar, and a number of literacy texts [62].

All four Usurufa villages have a history of kuru, and only seven cases have been recorded since 1957.

Awa

The Awa are a linguistic group of the Eastern Highlands located on the east side of the Lamari River north of its junction with the Aziana River, and on both sides of the Lamari as it runs east-west. Thus, six Awa villages (Tainoraba, Kairaba, Amoraba, Mobutasa, Agamusei, and Owapei) lie between the Aziana and Lamari Rivers and two (Yakia and Tauna) across the Lamari to the north. A total of 1,200 Awa-speaking people live in the eight villages. The country of the Awa is largely kunai-covered with forested summits of the ranges above the Awa villages. The neighboring Fore to the west refer to the people of the Awa villages, as well as those of three Awa-related villages of their own (Abomatasa, Awarosa and Ilesa) as the *Pore kina* or *Fore kina*, whence the name Fore, now mistakenly applied to the 15,000 Fore. Awa is similarly a rather arbitrary European designation for a linguistic group that did not have a term to embrace all people speaking the language. The Awa are among the best bow-and-arrow makers of New Guinea; their black palm bows and heavily carved arrows armed with long barbs and decorated with yellow orchid fiber braiding are in great demand by the surrounding groups.

Their language belongs to the Gadsup-Auyana-Awa-Tairora (eastern) family, and is most closely related to Auyana and Gadsup. McKaughan [61] describes three dialects, Mobuta, Elakia, and Tauna, of which Mobuta is the most divergent. To the south they are bordered by the Simbari-speaking Anga (Kukukuku) people of the Moraei (Dunkwi) group and the Barua-speaking Anga people of the Wugamwa River valley (Wantekia, Aurugosa, Dumbulia, and Wenabi groups); and to the southeast, upstream along the Aziana River, by the Genatei (Azana) group, a Fore-related people. Further eastward along the Lamari, the Owenia-Waisara group forms an ever-hostile border with Tainoraba, and beyond them Pinata and other Tairora-speaking groups occupy the Lamari headwaters. The villages north of the Lamari are bordered to their north by Auyana speakers. To the west are the Fore, easily reached in the north, but further south separated from the Awa by the fast-flowing Lamari River.

The Awa live in rather large villages and hamlets. Their women's houses are shaped like beehives and raised a foot or more above the ground on bamboo or limbum palm flooring. The men's houses are much larger-domed, with the earth as the floor, and there is a separate one for each of the three age-group divisions of the males: the uninitiated boys in the smallest, the initiated unmarried males in the second, and the married adult males in the third. Their clothing is remarkable in that a thick grass skirt, or sporran, is worn by the men and initiated boys in the fashion of most North Lamari groups, and under these the initiated youths and men usually wear a *tonana*, or tight hip-band penis corset [65]. Traditionally, boys marry at an unusually early age for Eastern Highlands groups. Courting ceremonies in which the girls snap bamboo sticks repeatedly against the upper arms of the boys to produce traumatic lesions which result in cosmetic scars (of which the youths naturally are very proud) are another unusual feature of the culture. Their agriculture is remarkable in the Eastern Highlands for the extensive use of bamboo piping for irrigation, with the water often brought several hundred meters, or even a kilometer, to the dried kunai-sloped gardens. During the dry season they often burn the best kunai slopes and chase and capture the many small rodents which try to escape from the fire.

The Awa people were brought under full administrative control only in the last 5 years. Their language has been studied by the Lovings of the Summer Institute of Linguistics [62, 66], who have produced a comprehensive dictionary and many literacy materials.

In the village of Yakia, which has established relationships with the Fore people, three cases of kuru have been reported.

Agarabi

The Agarabi (Agarabe) are a group of 10,500 people living along the northern boundary of the Eastern Highlands, at its eastern end between the Gadsup and Kamano linguistic groups. Their only other neighbor within the Eastern Highlands is Tairora to the south; to the northeast, in the Markham Valley, is the Amari group. They comprise 31 villages in an area of 107 sq miles. The region contains the large loop of the Ramu River as its direction of flow changes from east to northwest to pass out of the Eastern Highlands.

The Agarabi language is in the Gadsup-Oyana subfamily of the Gadsup-Auyana-Awa-Tairora (eastern) family of the East New Guinea Highlands stock. McKaughan [61, p. 109] regards it as a dialect of Gadsup. The language and culture has been studied by J. B. Watson, and members of the Summer Institute of Linguistics (Jean Goddard and Lorna Luff) have undertaken linguistic analysis and prepared literacy materials [62].

One of the unique findings among the Agarabi is the making of pottery in one of their northernmost villages (and in a neighboring Kamano village). Agarabi pottery is made by a coil technique, and two kinds of round pots with everted rims are made [67].

The history of early contact of the Agarabi people with Europeans is the same as that of the Kamano (see above). The administrative center of Kainantu, which was first set up as a patrol post in 1932, is situated at the southwestern corner of the Agarabi region. Early miners and evangelists following the Ramu River up into the highlands from 1926 on made first contact with them. The Agarabi do not suffer from kuru.

Gadsup

The Gadsup form a group of 23 villages with 9,000 people living in the northeast corner of the Eastern Highlands. They are censused from Kainantu, which lies at the junction of the Kamano, Agarabi, Tairora, and Gadsup linguistic groups. Their language forms a subfamily with Agarabi and Oyana in the Gadsup-Auyana-Awa-Tairora linguistic family. Oyana is an outlier of Gadsup, usually regarded as strictly one of its dialects, but the villages which speak Oyana are separated from those of the Gadsup by 2 days walk and by large numbers of Tairora- and Kamano-speaking people. Within the Gadsup area itself, the reverse situation is found: Binumarien and Kambaira are two Tairora-like

languages which are spoken in two separate villages within the Gadsup administrative division. To the north and east, Gadsup borders on Amari and Atsera Austronesian languages outside the Eastern Highlands. McKaughan [61] discusses three dialects of Gadsup—Oyana, Akuna, and Tompena—and describes Agarabi as a fourth.

The history of early European contact with the Gadsup is similar to that of the Kamano (see above). Being on the edge of the highlands, they were the first to be contacted (1919) and were closer to the events of World War II in the Markham Valley. There was some infiltration of Japanese patrols and trouble with villages "collaborating" with the invaders, but little direct involvement in the fighting. The return of civil administration after the war brought the Gadsup people under full control from Kainantu. Within their area the experimental livestock station at Arona was set up as well as the agricultural station at Aiyura, which has grown to be an important center for highland agricultural development; nearby at Ukarumpa, the Summer Institute of Linguistics established its New Guinea headquarters.

The Gadsup language is being analyzed and literacy texts are being prepared by members of the Summer Institute of Linguistics [68]; their songs have been examined by Chenoweth [69]; and their culture studied by Du Toit [70, 71] and J. B. Watson. They do not suffer from kuru.

Oyana

The Oyana (Oiyana) people live in scattered groups of hamlets and speak a language closely related to, and essentially a dialect of, Gadsup. Their population of about 1,300 is grouped into five administrative units, Ataiya (Uteia) 1 and 2, Oiyana 1 and 2 in the Kamano census division, and Ontenu in the Tairora division; both census divisions have Kainantu as their administrative center. The languages of Uteia, Oiyana, and Ontenu constitute the three dialects of Oyana. The Oyana speakers form a rough wedge passing between Tairora and Kamano, with its body in the west against the Usurufa and Kosena (Auyana) people and the thin edge trailing toward the main Gadsup area in the east. The "body" does not, however, form a clearly demarcated geographic unit, and its constituent parts fit between Kamano and Tairora villages. Oyana thus provides a very good illustration of the fragmentation and heterogeneity of Eastern Highlands populations, and of the likely complexity of their past and present linguistic—and genetic—relationships.

The history of their first contact and administrative control is the same as that of the groups which surround them. They do not suffer from kuru.

Tairora

The Tairora are a widespread group of people at the eastern edge of the Eastern Highlands. Their total population of 12,200 lives in 50 villages and is spread over an area of 530 sq miles, which extends from Kainantu in the north, through kunai-covered hills southward, into the steep mountains of the Kratke Range (elevation 3,000 m). It encompasses the Obura patrol post and the first part of the Lamari River as it flows south and approaches the northern slopes of Mount Piora. Their neighboring linguistic groups, starting from the north and going in a clockwise direction, are the Kamano, Agarabi, Gadsup, Atsera and Banir (two groups outside the Eastern Highlands), Genatei, Owenia-Waisara, Awa, Auyana, and Oyana. Administrative patrols from Kainantu take the annual census of the northern half of the Tairora area, while in the southern half it is taken from the patrol post of Obura.

The Tairora form two main cultural divisions: the Pinata-Kokonbira-Oraura group in the southwest corner of the region and Tairora proper. The population of the first group is 730 or only 6% of the Tairora total, but culturally they form an important division.

Pinata-Kokonbira-Oraura division of Tairora. High above the left shore of the north Lamari, at the forest line above the kunai-covered slopes which rise from the Lamari gorge to the ridge of the Aziana-Lamari Divide, one encounters the hamlets of Pinata,

Kokonbira (Konkonbira; Kokonbila), and Oraura, respectively, as one progresses upstream. The people speak languages progressively more closely related to Tairora, but the difference, at least when one is at Pinata, may be more than at the level of a dialect. The adults can make themselves understood in the central Tairora villages around Obura patrol post, but insist that their own tongue is a language distinct from that of these central Tairora villages. The cultures of the three villages are very similar, yet distinct from those of the main body of the Tairora people and from those of the Awa downstream. They form a culturally transitional group between the Awa and the central Tairora. They are a fierce, fighting people, often at war with one another. Their youths are accustomed to enjoy rather ceremonial warfare which calls for fine displays of body and face painting, decorated shields, and bows and arrows; they wear grass skirts or sporrans fore and aft, and underneath this the penis corset similar to that of the Awa. They have long had trading contact with the Imani group of Barua-speaking Anga (Kukukuku) on the Aziana River side of the range. They have adopted the Awa practice of irrigating their steep gardens with bamboo tubes, but do not use it as extensively as the Awa.

On the same side of the Lamari and downstream from Pinata, the Owenia-Waisara people form a two-village, 350-inhabitant, separate language group, and just beyond these villages are the Awa people. Across the Aziana-Lamari dividing range and downstream from the Imani Anga villages lie the three villages which comprise the Genatei (Azana) linguistic group of 500 people.

Tairora proper. The Tairora language is in the Tairora-Binumarien subfamily of the Gadsup-Auyana-Awa-Tairora family. Binumarien and Kambaira both belong to the subfamily; these languages are spoken by separate villages of less than 200 people each, and are situated completely within the Gadsup linguistic group to the north of Tairora. Owenia-Waisara also probably belongs to the same subfamily; it is spoken by a few hundred people to the south beyond Pinata. The language of Pinata-Kokonbira-Oraura, if it proves not to be just a dialect of Tairora, which is how we have classified it, will also belong to this same subfamily. As far as the main Tairora language is concerned, McKaughan [61] describes three dialects: two in the Tairora valley, Abiera (Abiqera) to the northwest, and Batainabura to the northeast; and a third, Baira, in the center and south. He suggests that Binumarien may be a fourth, and that a fifth, Suwaira, may exist between the Tairora valley and southern dialects. The southeastern corner of Tairora is designated by Pike [72] as Waffa (Woffa), a separate language in the same subfamily; the people that speak it live just outside the Eastern Highlands, in the Morobe subdistrict. The Tairora language has been studied by members of the Summer Institute of Linguistics (H. B. Kerr and Alex and Lois Vincent), who have produced a dictionary, preliminary grammar, literacy texts, and translations [62]. The Tairora culture, with special reference to horticulture, has been described and analyzed by Watson as part of the microevolution studies in New Guinea [30, 73-75].

Around Baira, in the southern Tairora, there is a limited area with a marked degree of endemic goiter. None of the Tairora groups suffer from kuru.

Owenia-Waisara

The Owenia-Waisara are a small group of people numbering about 350, speaking a language of their own that has not yet been studied. They live north of the north Lamari-Aziana Divide across from the Genatei (Azana) people in two closely adjacent groups sandwiched between the Pinata people of Tairora stock and the Tainoraba hamlets (Kairape, Tainowirape, and Tainorape) of the Awa linguistic group. It is obvious from preliminary word lists that a few of the Owenia-Waisara words are the same as (or very similar to) Awa words, and a smaller number are Genatei cognates; but more seem to resemble those of the Pinata Tairora people. Yet, both Owenia-Waisara and Pinata claim that their languages are not mutually intelligible.

Along the north Lamari, upstream and eastward from the Awa village of Mobutasa

and the Fore villages of Ilesa and Abomatasa, language group affiliation extends from high on one range across the Lamari gorge to the top of the opposite slope, an arduous full day's trip in many cases; it does not extend far along the same side of one bank. Thus, one passes from the belt of Awa-speaking villages—Mobutasa, Amoraba, and Tainoraba on the left bank of the Lamari, and Irakeia, Tauna, Meiwawa, and Okorotaba on the right bank—past the Owenia-Waisara villages to Pinata and Kokonbira, whose language (a Tairora dialect) is closely affiliated with the language of the Baira villages across the river. Further upstream, Oraura, in the Pinata-Kokonbira group, is at the same time very like Nobaira, across from it. Then, at the headwaters of the Lamari, one enters pure Tairora country.

Culturally, the Owenia-Waisara people are not unlike the Pinata people, but they have many Awa traits as well. They have traditionally been enemies of the Genatei across the Aziana-north Lamari Divide, and have also fought with both the Pinata upstream and the Tainoraba downstream when they were not fighting with each other.

The large, round, domed, men's houses, with an earth floor and divided into small sleeping cubicles, each with its own fire, resemble those of the Fore; the women's houses are raised, with bamboo floors and in the beehive style characteristic of north Lamari groups on the southern side of the river. This housing style may also be borrowed from the Anga (Kukukuku). The male youths marry early, as among the Awa, and to a lesser extent among the Genatei, and they practice the same group courting and dalliance rituals involving youths, young married men, and unmarried girls as do the Awa and the Genatei. The penis corset, or *tonana* (Awa), is worn by the youths. They use the same type of arrows and soot-blackened, heavy shields, decorated with incised carving, as do the Awa.

They live in the tail of the goiter belt extending down the Lamari from Baira, but have relatively little goiter. They do not suffer from kuru.

Genatei

The Genatei (Ganati; Azana) people live in three villages, Arebunkara, Orobina, and Yabwiara, on the southern slopes of the Lamari-Aziana Divide. They number about 500. Culturally, they show close similarities to the Awa people to the west, to the people of the two villages which comprise the Owenia-Waisara linguistic group over the divide, and to the Tairora people of the three villages of Pinata, Kokonbira, and Oraura which lie above the Lamari gorge on the northern side of the divide. Early marriage of males and the group courting and dalliance rituals as practiced by the Awa are found also among the Genatei. Their other neighbors are the Imani group of Barua-speaking Anga (Kukukuku) to the southeast. They are continually in an uneasy state of war with all of their neighbors, but open conflict is less likely since the establishment of full administrative control over the area in the last five years. They are administered and censused in the Aziana census division from Marawaka patrol post in the Wonenara subdistrict. The TEAM mission has had workers settled intermittently since 1965 between Arebunkara and Orobina villages. Walled in and surrounded by hostile, belligerent enemies, the Genatei were fierce fighters and offered more resistance to government control and administration than have other Eastern Highlands groups. Their method of fighting relies on shields and bows and arrows rather than clubs, maces, and axes, as among the Anga.

The Genatei language has not been fully analyzed yet, but has definite relationships to Fore. For this reason, we have classified it in table 1 in the Fore-Gimi subfamily of the Gende-Siane-Gahuku-Kamano-Fore (east-central) family. Their Awa and Owenia-Waisara neighbors trace the origin of the Genatei to migration from the Fore side of the Lamari River up the Aziana Valley only several generations before European contact, but the Genatei choose to deny this. Today the Genatei people have little in common culturally with the Fore, but the relationship is acknowledged in subtle ways, socially as well as linguistically, in the marked similarity of some of their songs, and in the construction of their large communal men's houses. There is now established contact between Fore and

Genetei across the intervening Awa villages, but before administrative control the Fore had lost all contact with these people and were unaware of their existence. Yet the first Fore brought into contact with them on our exploratory patrols were astounded to note the similarities in language, song, and culture between their own traditional culture and that of the Genetei [76]. Marriage and other forms of regular socioeconomic exchange, however, no longer take place. How long ago they lost contact with the Fore we do not know. No cases of kuru have been reported among the Genetei [76]. The Barua people of the Anga linguistic stock have been traditional allies of the Genetei in their wars with the Imani and Wantekia Anga. Many Barua Anga cultural traits have been adopted by the Genetei.

Gumine

The Gumine people are a large group of 27,500 people living in the southern part of the Chimbu District, along the western edge of the Eastern Highlands. Their 120 villages are censused from the Gumine patrol post. They occupy an area of about 480 sq miles, bordered by the Chimbu and Dom to the north; Sinasina, Chuave, Salt-Yui, and Nomane to the east; Pawaian and Mikaru to the south; and Wahgi to the west. They form a group of five dialects with close linguistic relationships to Dom, Sinasina, and Salt-Yui.

The whole problem of language and dialect in the New Guinea Highlands is exemplified in an extreme form by these languages. Wurm [43] refers to Gumine as one of the dialects of the "Dom dialects." Deibler and Trefry [45], on the other hand, in their analysis of Chimbu District languages, classify each of the "Dom dialects" as a separate language. These languages are currently being studied by Gordon Bunn and Barry Irwin of the Summer Institute of Linguistics, who have described five dialects of the Gumine language group (Yuri, Golin, Mian, Keri, and Kia) which may be distinguished from Dom, Sinasina, and the Yui dialect of the Salt people (G. Bunn and B. Irwin, personal communication, 1970). However, each of these "dialects" is also composed of dialects (from two to eight each). Further, the Keri "dialect" is as close to Yui, the Salt language, as it is to Golin, the major "dialect" of the Gumine group. Yet speakers agree that there is a difference between the Gumine "language" and the Salt "language." Under these circumstances, any hierarchical division into language and dialect will be at best arbitrary.

Whether as dialect, language, or language group, Gumine falls into the Chimbu-Sinasina division of the Chimbu-Chuave subfamily of Wurm's central family in the East New Guinea Highlands stock: the Hagen-Wahgi-Jimi-Chimbu family.

A village group in the junctional dialect of Keri was studied in our survey. It is the only group sample that we have so far taken from the Chimbu subfamily of languages. These people are remote from the kuru region, but share the general cultural characteristics of the Eastern Highlands. Although the land pressure in Gumine is not as great as it is in the Chimbu region to the north (their population density is of the same order as that found among the North Fore or the Kamano), they show certain cultural and physical resemblances to the Chimbu people. The Chimbu people and their region have been intensively studied by Reay [77] and Brookfield and Brown [78].

GROUPS BELONGING TO THE ANGA LINGUISTIC STOCK

The Anga linguistic stock is a group of some 75,000 people speaking nine different non-Austronesian languages, a few of which may be divided into several dialects each (fig. 7). The Anga people have more commonly been called the Kukukuku in colloquial parlance and literature; however, since the name has a derogatory derivation and connotation and is used by their neighbors in an insulting manner, all Anga people reject it although they have no common designation for themselves or their language. Yet, they do form a recognizable linguistic and cultural complex with their nine languages showing distinct linguistic affinities within a stock level of interrelationship (greater than 12% cognates); their

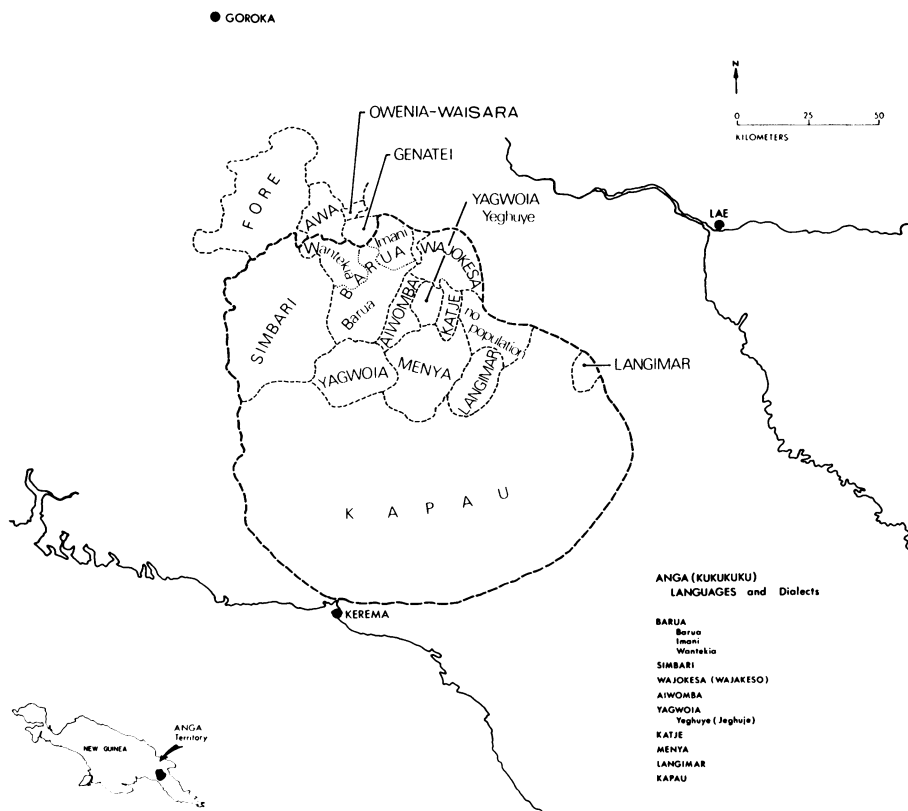


FIG. 7.—The Anga linguistic stock of nine separate languages contains only two groups that are administered in the Eastern Highlands: Simbari and Barua. The boundary of these languages with several languages of the East New Guinea Highlands stock forms the sharpest linguistic and cultural discontinuity in the Eastern Highlands. Barua is divided into three dialects: Barua, Imani, and Wantekia. Along its western border, and just east of the Vailala River in Papua, the Kapau language has three dialect-level divisions, not shown on this map. These are, from north to south, Mbwei, Ivori, and Lohiki.

cultural style, kinship patterns, material culture, and personalities all fit into a rather uniform complex which stands in sharp contrast with those of surrounding peoples [46].

Only the small northwest portion of the vast territory inhabited by the Anga peoples is administered within the Eastern Highlands; the remainder lies in the Morobe District to the east and in the Gulf District of Papua to the south. In Papua, these highland people live in progressively lower mountain ranges and hills, until, near the Papuan Gulf, a few villages are on tidal streams on the coastal plain. The major Anga language, Kapau, is spoken in over one-half of the area inhabited by these people, whereas the remaining eight languages are all crowded into the northern portion of the Anga area. The accompanying map locates the Barua and Simbari, the only two Anga people living in the Eastern Highlands, with respect to the other Anga language groups (fig. 7). These two groups were the last to be brought under administrative control when the Wonenara patrol post was established in 1963. Administrative control of the Wonenara subdistrict was shifted

to Marawaka in 1969. There is a little-investigated population of Anga speakers on the western edge of the Kapau language group in Papua whose languages may be dialects of Kapau. Lloyd calls these groups, lying just east of the Vailala River, from north to south, the Mbwei, Ivori, and Lohiki, respectively [78a]. They do not appear separate from Kapau on the map in figure 7.

The border between Anga stock and the Eastern New Guinea Highlands stock is one of the sharpest lines of cultural and linguistic discontinuity in the New Guinea Highlands. Most of it is formed by the Lamari and Aziana Rivers along which the Simbari speakers meet the Fore and Awa peoples, and the Barua speakers meet the Awa, Genatei, Owenia-Waisara, and Tairora groups. All of these neighboring peoples except for the Fore have adopted such Anga traits as the reed sporrans and raised platform floors in the women's houses. The use of bark capes, some aspects of the elaborate pattern of sex avoidance practiced by the boys of early initiation level, and extensive name-calling taboos as practiced by the northwestern Anga have apparently diffused into these adjacent groups.

At the time of first European contact, all the highland peoples bordering the Anga on the north were at intense war with them and there were many stories of the Anga raiding and extending their territory to encroach on that of their neighbors. The archaeological evidence suggests that a people sharing at least the material culture of the Anga inhabited the Eastern Highlands north and west of the current Anga area as far as Kainantu and Goroka. Thus, a wide range of drilled stone club heads was found in the gardens and village sites of the people of the Eastern New Guinea Highlands stock which their people can neither name nor interpret, and which are yet immediately familiar to Anga peoples as heads of clubs similar to those manufactured and used by them until very recent times. The possibility that the belligerently expanding Anga were only trying to regain from the highlands people the territory they previously had occupied must be considered. Warfare, loss of territory, and forced withdrawal from the central area of the Eastern Highlands might account for the wide variety of languages in the northern part of the Anga territory, as opposed to the uniform dominance of the Kapau language in the southern half. These northern Anga languages would thus be expected to show, as they do, the influence of different adjacent East New Guinea Highlands stock languages to the north, reflecting perhaps the groups they fought with and from whom they had captured women and children as they withdrew.

The Anga languages have affiliations with Wurm's East New Guinea Highlands linguistic stock and they are included with it in one phylum (5%–12% cognates). In Papua, the Anga stock lies to the west of Wurm's Central and South New Guinea phylum and to the northwest of his Southeast New Guinea phylum. Culturally, however, in spite of the inclusion of the Anga stock in the East New Guinea Highlands phylum, the Anga people appear to be much more closely related to the lowland inland New Guinea tribes of the southcentral part of the New Guinea coastal plain, and to such people as those of the Great Papuan Plateau and the Auyu of West Irian, than to other highland populations [46].

Although they border directly on the South Fore area of highest kuru incidence, the Anga have had no cases of kuru.

An extensive annotated Anga (Kukukuku) bibliography has been recently prepared by Gajdusek and Fetchko [79].

Barua (Baruya)

The Barua are a group of about 4,400 Anga people who inhabit the southeasternmost corner of the Eastern Highlands, in the northcentral part of Anga territory. Their language includes three distinct dialects: Barua, with about 2,800 speakers; Imani, with about 300; and Wantekia, with about 1,300. The Barua-Wantekia live in the northwestern part of the Barua area in the valley of the Wugamwa River, a tributary of the Aziana, which drains into the Lamari and finally into the Purari. Wantekia tribal groups are called

Dumbulia, Aurugosa, Wenabi, and Wantekia. They are separated from the Simbari linguistic group of Anga by the Lamari-Vailala Divide which rises to over 3,000 m in elevation. The Barua-Imani live on the upper reaches of the Aziana River, upstream from the Genatei with whom they were in frequent conflict. The Mount Piora massif (3,700 m) separates them from another Anga group to the east in the headwaters of the Waffa River, also called Imani, but who speak the Wajokesa language. On the southeastern part of the headwater drainage of the Aziana live part of the Barua-Barua, and south of them, across the Kratke Range (approximately 3,000 m elevation), the rest of the Barua-Barua live on the Ipmayaiga River headwaters of the Vailala drainage, in the tribal groups of Marawaka, Amdei, and Usurampia. Downstream they border on the Simbari speakers of the Injauinye, Iambananya, and Bulakia groups.

All the Barau are administered from Marawaka, in the Wonenara subdistrict of the Eastern Highlands District. The Barua-Wantekia are in the Wugamwa census division (10 census units), the Barua-Imani are in the Aziana census division (two census units), and the Barua-Barua are in both the Aziana census division (three census units) and Marawaka census division (23 census units).

The Barua were first visited by government exploratory patrols in the early 1950s, a decade after World War II; but not until 1963 did the government attempt to bring them and the other northwestern Anga people, the Simbari, under administrative control, with the establishment of the Wonenara patrol post. In 1968 this patrol post was moved across the Kratke Range to Marawaka. The Lutheran, the New Tribes, and the Seventh-Day Adventist missions have been working in the area only since 1965. At both Wonenara and Marawaka, small bush airstrips have been constructed, and a small mission airstrip has been built at Gawoi in the Usurampia.

The Barua (particularly the Imani, Barua, and Marawaka groups of Barua speakers) are the "salt people," the salt manufacturers and the best agriculturalists of the Kukukuku. Their success, both as primitive farmers and artisans, places them at the center of economic and commercial exchange for all Kukukuku and surrounding peoples. The mainstay of this position is based on their cultivation of a cane grass in the moist flatland of the valley floors for the purpose of salt manufacture, salt being extracted from the ash of the burned cane. The technology they have developed for this manufacture is one of the most complex found in any neolithic culture in Melanesia. The Barua, with the exception of the Dumbulia and Aurugosa groups, are all salt producers and their well-packaged trade salt has become a monetary item throughout the Kukukuku region and among surrounding tribal groups. Recently, the Imani and Wenabi have largely abandoned the technology, and salt production by even the major producers, the Barua and Marawaka, has been greatly curtailed.

In warfare, the Barua enjoyed a certain amount of immunity, for, although they were attacked and invaded by their hostile neighbors, the extinction or destruction of their salt-producing ability was not sought, except perhaps in internal fighting between Barua groups.

The Barua and the closely related Simbari group both practice an extensive sex avoidance and institutionalized form of homosexuality of the isolated male initiates during the first three stages of the five stages of initiation [46, 80]. A high incidence of male pseudohermaphroditism with congenital rudimentary or absent penis has been reported [81], which has also been observed on Tench Island east of New Ireland in the Territory of New Guinea and among the Tiwi Australian Aborigines on Bentnick Island.

The Barua and Simbari groups have been the subject of intense medical and anthropological studies by one of us (D. C. Gajdusek) since 1957 [46, 80-83]; and the Barua have been studied with particular reference to their economic and ceremonial life by the anthropologist Godelier for the last 3 years [84]. Richard and Joy Lloyd, linguists with the Summer Institute of Linguistics, have worked extensively since 1963 on the Barua language and on defining the other languages of the Anga linguistic family or stock [85].

Simbari

The Simbari are a group of about 2,000 Anga people who live in the northwesternmost portion of the large area of Papua and New Guinea inhabited by people speaking the nine languages of the Anga stock (fig. 7). These are the forest or woodland Kukukuku, living in dense rain forests of the Vailala and Purari River watersheds. They live on the east side of the Lamari River and across the Lamari-Vailala Divide in the valleys of the Aure, Puruya, and Kupbinga River headwaters of the Vailala River. All but the Iatwia live in forests in the narrow valleys with steep mountainous walls and gorges through which the headwater tributaries of these rivers rush down to the Papuan Plain. Westward across the Lamari River, they border with the Fore people. Near the New Guinea-Papua border area of the Lamari River, south of the Fore, they border with the Yar (Iare) group of Pawaian people with whom their southernmost communities of the Muniri group have had extensive contact by marriage and adoption. To the north they border with the Awa people and with the Barua-speaking Anga of the Wugamwa River valley, and on the east they inhabit the lower reaches of the Ipmayaiga River valley extending upstream to meet the Barua-speaking Anga of the Usurampia and Amdei groups. The major subgroups of the Simbari include the Dunkwi (Moraei) on the Lamari drainage; the Muniri in the Puruya valley, and also living on the Lamari-Vailala Divide; the Simbari, Malari, and Yatwia of the Kupbinga and Aure drainage; and the Bulakia, Iambananya, and Injauinye groups on the lower Ipmayaiga River.

They are the seminomadic Kukukuku, who, although possessing numerous small hamlets of rarely over a few dozen inhabitants, live also in widely separated smaller hamlets of one, two, or three houses, adjacent to small gardens in pandanus forest groves or in the deep rain forest itself. Thus, each married man has many different houses in which he and his wives and smaller children may sleep, and these are often separated by many hours of walking. These Kukukuku are more vigorous hunters and trappers than the Barua-speaking agriculturalists; they hunt the wild pig, cassowary, cuscus (opossum), tree kangaroo, and the bird of paradise. They trap eel in the valley streams and spend more time on food gathering and searching for seasonal foods in the forest than do the farmer-artisans of the salt-making groups. None of the Simbari-speakers manufacture salt; they purchase it from the Barua with bark capes (*nambai*, made from the beaten bark of a cultivated mulberry tree), with plumes of the bird of paradise, parrot or bird of paradise feather headdresses, small white cowrie shells (*girigiri*), bundles of yellow orchid stem fibers (used for braiding bands for forehead, belly, and chest), or with braided headbands.

For the groups situated nearer to the Papuan plain, the red pandanus fruit, and even sago, is an important food. Taro, more than sweet potato, was the dietary staple of the people before European contact. Many taro gardens were scattered wide in swampy land and gulleys throughout the territory, and their sweet potato crops were puny and unimpressive. More recently, however, many new varieties of sweet potato have been introduced, and these have now become the dominant staple.

In 1957 an epidemic of encephalitis killed many adults of the Mononi group of the Muniri tribe and the remaining women and children took refuge for most of the next decade with the neighboring Yar community of Weme, of the Pawaian linguistic group.

There is no kuru among the Simbari, although they have extensive contact with a Fore village of very high incidence (Agakamatasa in the South Fore).

STOCK-LEVEL ISOLATE

Pawaian (Yar; Tudawhe)

The Pawaian (Yar; Tudawhe) people number about 3,100. The majority live in a relatively small area east of Karimui and the remainder are spread over a heavily forested region of 900 sq miles which extends across the southern boundary of the Eastern Hig-

lands. They are censused, inasmuch as this is possible in the southern extent, from the Karimui patrol post.

The Pawaian people were known to the early Australian administrators of Papua even before World War I as excellent bushmen, canoemen, and carriers on expeditions into the interior from the coast of Papua. Many of them gained important positions on the police force of the Royal Papuan and the New Guinea Constabulary. They repeatedly served as guides and boatmen on expeditions up the large rivers of Papua, and after World War II many of them worked for the petroleum corporations in the oil exploration of Papua. However, although they were known to be "Pawaians," the location of their home villages far up the Purari River was often unknown to their Australian employers, and many of these villages had never been visited by white men before World War II.

In the early months of exploration into the kuru region, the Fore population was found to terminate with the South Fore villages of Paiti, Kasarai, and Mugaiaimuti; yet the Fore identified villages speaking their language which had occupied sites in the then uninhabited forest to the south: Abonai, Asapinti, and Irendi, the former homes of the *Yanarisa kina*. These people had inhabited sites which had been abandoned in the decade before our arrival. Further to the south, in low malarial country and with the sago palm providing the staple food, were found people who called themselves Yar (Iare). The older men spoke Police Motu, the lingua franca of Papua. Many of the Yar villages had not previously been visited. The people identified themselves as Pawaians and lived on the lower Tsoma and Subu (lower Lamari) Rivers and along the upper Pio River, all of which drain into the Purari. In 1961, when a new patrol post was established to serve the still warring, raiding, and cannibalistic people near Mount Karimui, these Yar people were identified as speaking a language called Tudawhe, the linguists and government officers being unaware that they were Pawaians of the upper Purari River.

The Tudawhe lived in rectangular houses raised several meters above the ground on many poles and having two floors; on the lower, the women and children lived with the pigs; and on the upper, the men and unmarried boys resided. Both had their own ladder-like stairway to the ground. From these huge fortresses housing the entire community, the men were able to defend their women and children from enemies by shooting arrows down upon a raiding party. The Tudawhe and their neighbors, the Mikaru (Daribi)-speaking people, were involved in extensive warfare and cannibalism. Many features of their culture, including extensive sex avoidance of their boys, strict taboos on calling one's own name, and the use of bark capes by both sexes, were apparently traits adopted from the Anga (Kukukuku) people to the east, with whom the easternmost Yar were in close contact, through marriage exchange and child adoptions. These people were the major hunters of the bird of paradise, the feathers of which they sold to the Chimbu living further into the highlands, who valued them as their main source of bride price. The hamlets of the Tudawhe ranged from a few hundred feet above sea level on the Purari River to forested mountain slopes no higher than 1,000 m. They lived by making sago flour from wild and cultivated sago, traveling vast distances in search of it from one sago camp to another. Thus, they were a seminomadic people, unlike the highlands people to the north. They were all excellent swimmers and canoemen, accustomed to navigating the Purari River and its tributaries.

The Pawaian, the Yar, and the Tudawhe are thus different names for one wide-ranging group of people. Wurm [43] estimated their language—which he terms Pavaia—to have 4% cognates with the East New Guinea Highlands stock, and this just puts it within the microphylum. He now classifies it [44] as a stock-level isolate (table 1) in the East New Guinea Highlands phylum (implying 5%–12% cognates with members of another stock in the same phylum).

We suspect close relationships between the Anga and the Pawaian on the basis of cultural and physical anthropological observations and the study of their material cultures and personality styles [46]. The Weme group of Pawaians took the remnants of

the Mononi group of Muniri people (Simbari-speaking Anga) into their village for almost a decade after collapse of their hamlets upon the sudden death of many adults from epidemic encephalitis in 1957 [46]; there are many adoptions between the two border groups.

At the time of European discovery, the Tudawhe were intensely afflicted with leprosy, with over 10% of their people severely affected. There had been some marriage exchange between these people and the southernmost Fore and, especially, with Gimi-Labogai people. Presumably, the high incidence of leprosy in the Gimi region was the result of this contact, and as a guess, bird of paradise hunters on the Purari may have introduced leprosy to the Pawaians before or at the beginning of this century. They have not suffered from kuru.

SUMMARY

Investigations into the disease kuru have included a genetic study of affected and nonaffected populations in the Eastern Highlands of New Guinea, within and adjacent to the kuru region. This introductory paper describes the groups studied and their linguistic and cultural relationships. Each of the 37 linguistic groups of the Eastern Highlands is composed of one or more effective population isolates, but a history in the recent past of changing alliances, fission and fusion of groups, and affiliation of individuals to groups implies considerable genetic exchange between these population isolates. A brief definition is provided for each of the 20 groups which have been specifically studied and sampled.

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