

New Guinea Research Unit Bulletin

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AN INTEGRATED APPROACH TO NUTRITION AND SOCIETY

THE CASE OF THE CHIMBU

Report of a Symposium held at the

Thirty-Seventh Congress

of the

Australian and New Zealand Association

for the Advancement of Science

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January 1966

Editor's note

This number of the New Guinea Research Unit Bulletin is devoted to the proceedings of a symposium delivered at ANZAAS in January 1964. Papers were prepared for publication in April 1964 when it was anticipated that another organization would print the proceedings. This proposal had to be abandoned, and in September 1965 the manuscript was put in the hands of the New Guinea Research Unit.

Though the papers have been subjected to only minor revision since April 1964, and some of the contemporary matter in them is already outdated, it was felt that they offer collectively both an interesting illustration of interdisciplinary discussion on the problems of an area, and also an analysis of the process of colonial development and change as applied to one small part of New Guinea. The peanut-food project itself, which was the origin of the symposium, has been in abeyance for some time.

R. G. Crocombe

Preface

The papers comprising the Symposium entitled 'An Integrated Approach to Nutrition and Society - the Case of the Chimbu' were presented to the Thirty-Seventh Congress of the Australian and New Zealand Association for the Advancement of Science held in Canberra from 20th-24th January, 1964.

The original idea of the Symposium was to try to make the specialist approaches of science meaningful in terms of human needs. Different scientific disciplines accumulate different kinds of facts, and the techniques of collecting and handling them are complex and various. The resulting specialization may give us a profundity of knowledge about the separate aspects of a problem, but many questions require a more general answer. It seemed worthwhile for scientists in several different disciplines to apply the relevant portions of their knowledge to a limited human problem.

The region of Chimbu is one of the most populous parts of New Guinea, so it is not surprising that during the last few years a good deal of sociological, agricultural, medical, and other research has centred on the Chimbu people and their environment. Medical findings showed that Chimbu toddlers would benefit from increased dietary protein. Efforts to increase the cropping and consumption of peanuts as a means to this end had already begun. It seemed to us that an examination of this dietary problem and of efforts being made to overcome it might lead to an appreciation of the ramifications of a comparatively simple change in a living habit and to a greater understanding of culture change if specialists in various fields could discuss these things jointly. People moving from a primitive form of society into the complex modern world are faced with many comparable problems which may also be usefully studied in this way.

The Organizing Committee welcomed the idea of an interdisciplinary Symposium of this kind because it seems to serve the aims of such a Science Congress; the exchange of ideas and circulation of knowledge among scientists who are themselves specialists and, essentially for this purpose, the translation of specialists findings into terms which are intelligible to non-specialists.

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Contents

	Page
Chairman's opening remarks	1
<u>Part 1. The people and the problem</u>	
Protein malnutrition and peanut foods in the Chimbu - K. V. Bailey	2
Goodbye to all that? - Paula Brown	31
But where do we go from here? - H. C. Brookfield	49
Nutrition and economic progress in the Chimbu - R. Shand	67
<u>Part 2. Practical prospects</u>	
Community development and the Chimbu - W. E. Tomasetti	85
Introducing peanut butter into Chimbu infant diet - June Anne Ross	95
Experiences of peanut feeding in the Chimbu district - Noah Temgwe	104
<u>Part 3. Discussion of problems uncovered</u>	
	109

Tables

Table 1.	Average composition of New Guinea foods	4
Table 2.	Causes of death in Kundiawa hospital	26

Figures

Fig. 1.	Location map. Part of Chimbu Division of Eastern Highlands New Guinea	Opposite p. 1
Fig. 2.	Mean weights of infants	5
Fig. 3.	Map of the Mintima area	54
Fig. 4.	Pattern of sales in a Chimbu trade store	73

Plates

Plate 1.	Kwashiorkor	12
Plate 2.	Marasmus	15
Plate 3.	A group talking outside a men's house	45
Plate 4.	A group of women cook for a feast	45
Plate 5.	Men digging ditches and spreading subsoil to prepare garden beds	51
Plate 6.	Peanuts as part of a ceremonial distribution	51

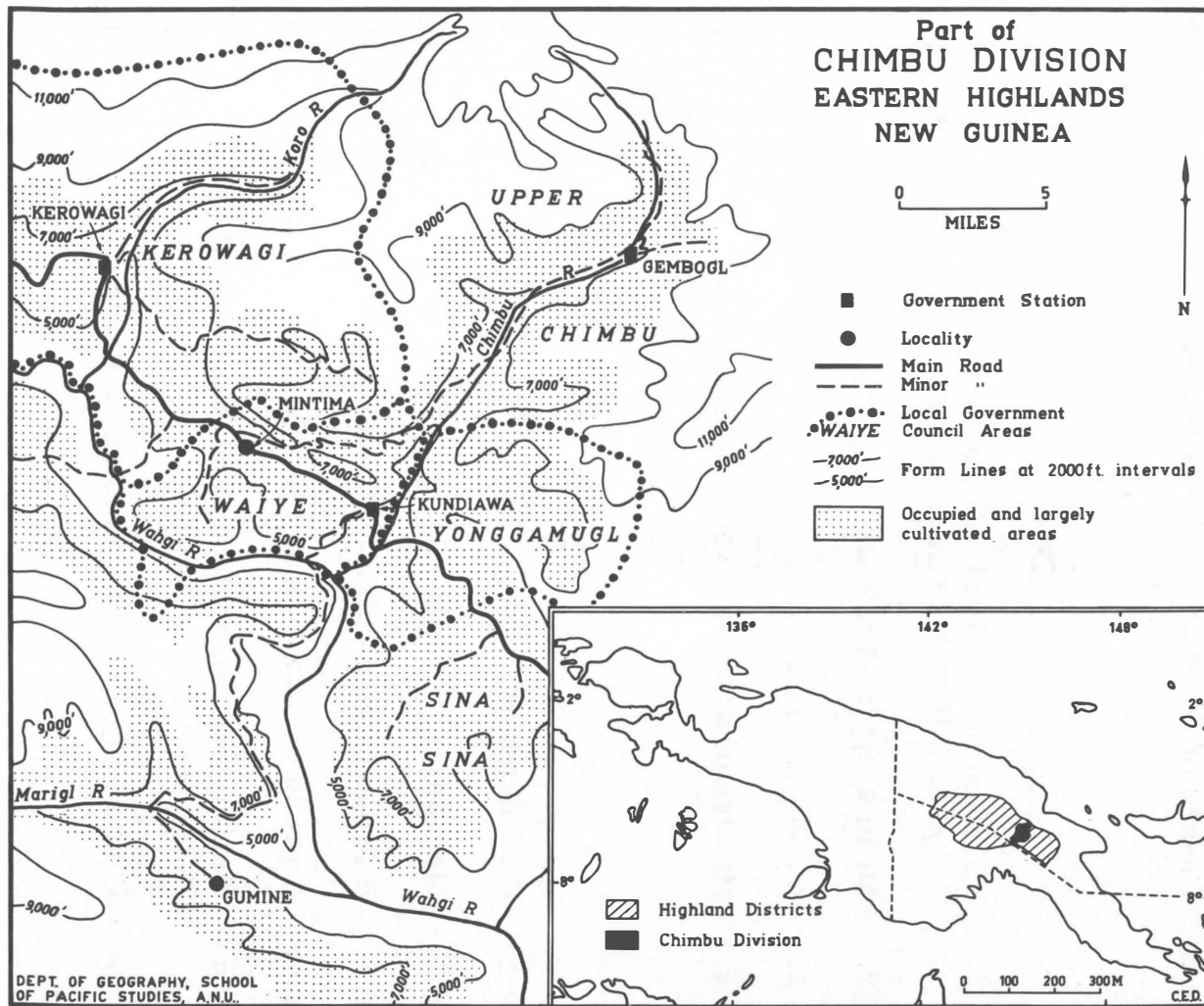


Figure 1. Location map. Part of Chimbu Division of Eastern Highlands New Guinea.

OPENING REMARKS

Chairman, Sir John Crawford
(Australian National University)

We have a very full day on a subject that may sound very particular since it deals with the problem of protein in the diet of the Chimbu people in New Guinea, (see Fig. 1), with particular reference to the peanut as a source of protein. But if you think the word 'peanut' means a restricted unimportant subject then you are in for a pleasant disappointment, because the problem of feeding peanuts to young toddlers turns out to be one that raises the whole gamut of the mode of adjustment of a primitive society to new conditions.

Protein malnutrition and peanut foods in the Chimbu

K. V. Bailey

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Protein malnutrition was first recognised as a major clinical and public health problem in New Guinea by Ivinskis^{1, 2} at the Kundiawa hospital in the Chimbu Subdistrict of the Eastern Highlands of New Guinea. It affected chiefly young children, and pregnant and lactating women.

Detailed studies were made in the Chimbu in 1956 by Venkatachalam,³ an expert Indian medical nutritionist, and in various parts of New Guinea by Oomen and Malcolm, the South Pacific Commission nutritionists.⁴ These various studies confirmed that protein malnutrition was an important problem chiefly among infants and young children. Kwashiorkor and other forms of protein malnutrition were common in the Highlands generally, where the sweet potato (Ipomoea batatas) is the staple food, and especially in the Chimbu, which is the most densely populated part of the Highlands. Malnutrition also occurs amongst children in some of the swampy coastal and inland areas where sago is the staple food.⁴ Various reports^{5, 6} deal with the dietary picture and nutritional status in more detail.

At Kundiawa Hospital, Venkatachalam found that in 1954-56 malnutrition was responsible for 27% of the deaths in children under 5 years of age. In 1961-62 it was still responsible for 13% of admissions in this age group.⁷

Chimbu infants are normally relatively well nourished up to about 4-6 months,^{3, 4, 8} but beyond this point the mother's milk supply is inadequate to meet the increasing protein needs. Too little supplementary food is given; it is begun too late (usually at about 8-10 months); and it is too low in protein content. During the second year of life, calorie intakes usually become relatively adequate, but protein intakes remain outstandingly low.

Consequently there is a general retardation of growth,

chiefly from 4 to 24 months. This has been shown not only in Chimbu,^{3, 4, 8} but also in the Western Highlands,⁹ New Ireland,¹⁰ the Trobriands and elsewhere.¹¹ This retardation is as severe as any in the world, being comparable to the retardation found in rural Javanese infants and of Congolese⁸ (Figure 2). This figure shows the average weight of Chimbu village infants for the first 2 years of life, compared with various other population groups. The infants reared on Kundiawa station (their parents being Chimbus employed as domestic servants or by administration, mission or private establishments) gain weight distinctly faster than the village Chimbu infants. The improved performance of the Kundiawa infants is partly attributable to improved diets because of the rations (including rice, wheatmeal and meat) issued to the parents.

The overall incidence of severe malnutrition is about 3% in the 0-5 years age group in Chimbu.⁷ (These are classified as kwashiorkor, $\frac{1}{2}\%$; nutritional marasmus in toddlers over 6 months, $1\frac{1}{2}\%$; nutritional marasmus in infants under 6 months, 1%.)

If this figure were generally applicable in the Highlands, there would be some 4, 500 cases of frank malnutrition in an area served by about 30 hospitals; i. e. about 3 new cases per week in each hospital. An incidence of this order would of course be present only relatively early in the public health programme; later the incidence should be reduced to at most one fifth of this, and already this is the situation in the more sophisticated and accessible centres.

The Chimbu region was selected for special study because it appears to be reaching the critical point, where increasing population and land pressure are producing nutritional consequences on a greater scale than elsewhere in the Highlands. Doubtless, however, other areas will follow the Chimbu pattern if effective preventive measures are not taken.

The estimated incidence in Chimbu may be compared with a total incidence in the same age group of 2.7% found in South India,¹² 6% in Malaya,¹³ and 0-21% in various Uganda tribes.¹⁴ These figures are of course not strictly comparable, because the criteria and standards of malnutrition are not identical. Nevertheless they indicate that malnutrition is as much of a problem in parts of New Guinea as it is in parts of Asia and Africa. At the same time they confirm the general impression, on a casual visit

to a New Guinea village, that most of the children, as well as the adults, appear adequately nourished - or at least well fed, which is not quite the same thing.

Diets

Subsistence nutrition is the rule in most of rural New Guinea. It means that the people grow what they eat, and eat what they grow (or catch in the forest or sea). It need not mean poor nutrition, but often the diets are low in protein, especially animal protein. It also means that usually people find something to eat when they become hungry, rather than eating (or overeating!) to anticipate hunger, as in affluent societies like our own. Undernutrition in the sense calling for "freedom from hunger" efforts does sometimes occur in certain localities; overnutrition and "overweight" do not occur in rural populations.

Dietary surveys in many localities have shown very low protein intakes, and calorie intakes whose adequacy is sometimes doubtful. The main staple foodstuffs in New Guinea are: sweet potato (Ipomoea batatas), taro (Colocasia spp.), yam (Dioscorea spp.), banana or plantain (Musa paradisiaca) and sago (Metroxylon sagu). These are all essentially starchy foods. The average calorie and protein contents are shown in Table I, but there are hundreds of different varieties of each of the tuber species, and they vary widely in protein content. Yam and taro are generally better in protein content than sweet potato and banana. Sago is worse, being almost pure starch. Yam and taro supply slightly less protein per calorie than English potatoes and rice.

Table I

Average composition of New Guinea foods

<u>Item</u>	<u>Moisture</u> (%)	<u>Protein</u> (%)	<u>Calories</u> (Kcal per 100g)
Sweet Potato*	68	1.1	120
Taro*	70	2.4	130
Yam*	75	2.5	130
Plantain*	75	1.1	130
Sago**	17	0.1	350

Quoted as composition of raw edible portion of fresh foodstuff.

Average values quoted for New Guinean foods analysed at the D.A.S.F. laboratories (Port Moresby)* or at the Institute of Anatomy (Canberra).**

MEAN WEIGHTS OF INFANTS

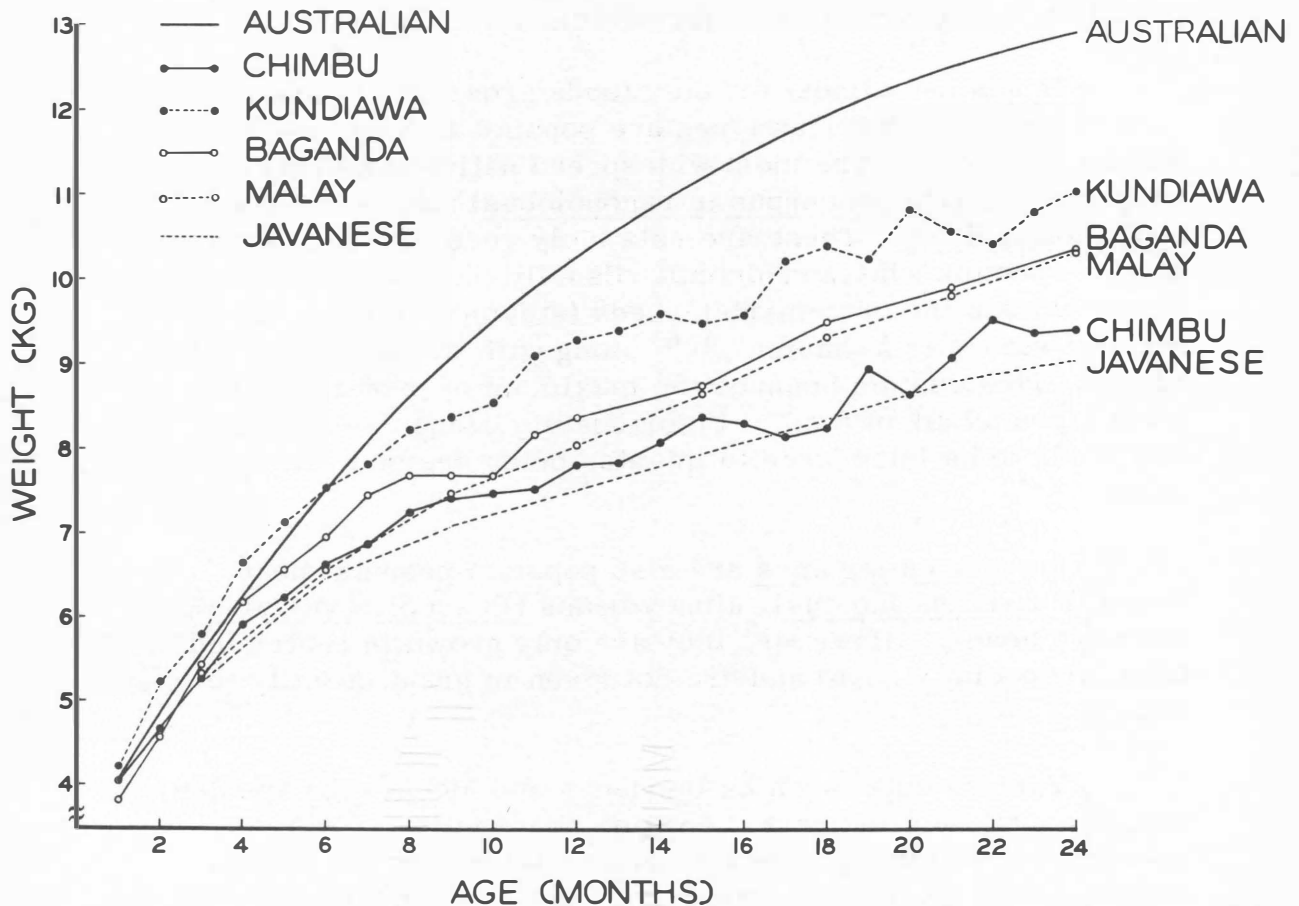


Figure 2. Mean weights of infants

Throughout the Highlands region, which comprises $\frac{3}{4}$ million people (almost one-half of the Territory's population), the sweet potato is quantitatively speaking almost the only food which counts. It supplies about 90% of the calories and 50% of the protein consumed, not only by adults but also in the supplementary diets of children from 1 year onwards. Adults usually eat 4 lbs, and toddlers 1-2 lbs daily.

Leafy greens and other vegetables are eaten in considerable quantity: often exceeding 1 lb daily for adults, but only a

few ounces for toddlers. The supply is greatly curtailed in the dry season. They provide large amounts of most minerals and vitamins and some protein, but are too bulky and too low in protein to be regarded as major protein-rich supplements.

Beans are almost the only foods grown which are relatively rich in protein. Various types are popular as food, but are also mainly seasonal. The most widespread native bean species are winged beans (Psophocarpus tetragonolobus) and field beans (Dolichos lablab). These are relatively good sources of protein (20-25% protein when sun-dried). Usually the fibrous pods are discarded and the protein-rich seeds (steamed under pressure with hot stones in a "mumu",^{4, 6} along with the other foods) are eaten. This custom ensures the maximum of protein intake from a given bulk of food. Unfortunately beans are amongst the last foods to be introduced to infants, being deemed "strong" foods.

Introduced legumes are also popular: peanuts, peas, lima beans (Phaseolus lunatus), kidney beans (Phaseolus vulgaris), and soya beans. However, they are only grown in restricted areas (especially soya) and are not given in great quantity to infants.

Various nuts (such as Pandanus and Macaranga species) are also available in great quantities seasonally. Their sporadic consumption in bulk contributes little to the protein budget, since protein supplements need to be eaten frequently and regularly, even if in small amounts, to be effectively utilised. But some nuts are stored and eaten from time to time, and some could be suitably processed (like peanuts) for infant feeding.

In the Chimbu Subdistrict, and generally throughout the Highlands, animal foods are eaten only rarely, comprising chiefly birds and other hunted game, and pigs. Pigs are eaten chiefly at festivals. The largest of these recur at 5-10 year intervals, with lesser ones every few weeks, months or years in relation to family events (birth, puberty, marriage, sickness, death) or religious occasions (especially Christmas). Other animal foods - insects, reptiles, rats, frogs - were said to be eaten occasionally, but it seems unlikely that they ever contributed major quantities of protein, and nowadays, as sophistication spreads, their consumption dwindles.

Although large numbers, even hundreds, of pigs are slaughtered at the major festivals, the quantities of pork eaten per person are surprisingly small. Eaten in this way, only sporadically, it makes a negligible contribution to the overall protein picture; a regular small intake, along with other foods, would be much better. Toddlers are given very small quantities or none at all, and it is doubtful whether one should advocate it, because of the very real danger of food poisoning from the fly-festooned fragments handed round.

There seems to be little prospect of supplementing villagers' diets regularly with other animal foods. Sheep do not adapt well to the humid conditions and fodder available. Poultry produce eggs at an economic level only when themselves supplied with diets much better than those of the people - including cereals, protein-rich foods and preferably imported meatmeal or fishmeal. Cattle have better prospects, but beef is usually sold in urban markets in such developing societies, rather than being consumed regularly by villagers. Domestic milk production under village conditions would require a high level of animal husbandry, and again, better foods (including animal protein supplements) are probably needed for adequate productivity. Fish also require special feeding. Research on all these possibilities is being actively promoted by the Department of Agriculture, Stock and Fisheries.

Infant feeding in the Chimbu is entirely from the breast until after the eruption of the first teeth, which occurs at about 8 months of age. The breast may be offered whenever the child cries. The baby is carried by the mother to the garden during her daily work there (2-4 hours), or sometimes left at home with an older sibling or the grandmother, especially in wet weather. Feeding seems to be usually every 2-3 hours by day and once or twice at night in younger infants; in older infants, every 3-4 hours, and in toddlers 3-4 times daily (and sometimes once at night). The first solid food offered is usually pit pit (Setaria palmaefolia; the asparagus-like inner stem), when 2 or 4 teeth have erupted. Baked (steamed) sweet potato is usually the next food introduced, followed (usually beyond 12 months) by other staples, leafy greens and beans. Breastfeeding is usually continued for 3-4 years. The amount of breastmilk is about 500 g (one pint) daily in the first year or so of life, thereafter gradually declining, but quite large amounts may still be available even in

the third and fourth years. The New Guinean mother is possibly the finest lactator in the world.

In recent dietary studies in two Chimbu localities,¹⁵ Whiteman carefully evaluated nutrient intakes in relation to estimated "adequate allowances" (calculated from Hipsley¹⁶), for all the individuals (based on their body weights) in the families studied. The main conclusions were that:

- (1) calorie intakes seemed to be reasonably adequate in adult males and in toddlers, but low in infants aged 6-12 months and schoolage children, and possibly in adult women;
- (2) protein intakes were about 50% of estimated requirements, at all ages. They are amongst the lowest in the world, but are not as bad as those in the cassava areas in Java, and the protein quality of the sweet potato is considerably better than that of cassava.

Concurrent studies of nutritional status in various localities¹⁷ indicated that protein malnutrition is probably the cause of a steady decline in the body weight of New Guinean adults with increasing age, from the third decade onwards. Nutritional oedema (swelling of the legs) occurs frequently in lactating Chimbu women,¹⁸ and especially in the Upper Chimbu valley. This reflects poor protein status, as found also in the cassava areas of Java.¹⁹⁻²¹

Despite such evidence of protein deficiency in adults, it is fair to say that New Guineans generally cause the visitor to comment on their fine physique, rather than on "how poor their diets must be". This is partly the result of a vicious process of natural selection which eliminates some 50-80% of the warriors before they can line up for battle dress. It is partly the result of a generous system of rations for employees and their dependants, and the spoils from the master's dining table, which present to the casual visitor in a sophisticated centre a much more sleek and blubbery picture of manhood than does the remote village. However, even in the remote village, the men especially are in obviously fine form. Both men and women can perform physical feats and show sustained stamina which few of us could match.

Customs and beliefs

Attitudes towards food, health and disease are dealt with in greater detail and depth by Brown and Ross later in this symposium, and the following comments are merely added from the nutritionist's point of view.

In general, unsophisticated New Guineans feel that they have enough to satisfy their food wants, and to keep them in good health. There is little connection between food and health. There is an almost infinite variety of food taboos, prohibiting the use of certain foods at certain seasons or, more particularly, for women during pregnancy or lactation. However, because the foods available are so generally low in protein, taboos are not often of much nutritional significance. An exception is the prohibition of meat in pregnancy or lactation in Maprik region (Sepik River)²² - but the taboo is not strictly adhered to, and meat is eaten so infrequently anyway that the generalisation still stands. Another harmful taboo is the prohibition of fish for pregnant and lactating women in the Trobriands.¹¹ It is in any case impossible to get concise and consistent views on most of these taboos.

Inevitably we tend to convey the notion that our foodstuffs are better than the indigenous ones, and New Guineans are often all too ready to believe so. As to vegetables this is usually not so.²³

Many of the indigenous greens such as Hibiscus, Amaranth and Rungia species, contain more protein, iron and calcium than our cabbage or lettuce. Cereals as a class have a higher protein content (per calorie) than sweet potato and banana (about twice), but very little higher than yams and taros, and the protein quality is usually somewhat less.

In relation to the subsistence nutrition pattern, the substitution of cereal for the tuber may entail risk of vitamin or mineral deficiencies.

Naturally there is little awareness of the relative nutritive values of the different foods available. There is a general notion of the superiority of meat, perhaps even a craving for it, and likewise fish. The superiority of pulses and nuts over other

vegetables is, naturally enough, unknown.

For infant feeding, the Chimbu pattern of supplementary feeding - too late, and too low in protein - applies to most of the Highlands. In some parts of the Territory supplementary feeding is begun early - within days or weeks of birth, e. g. in the Trobriands.¹¹ But invariably, the foods introduced are simply portions of the adult fare, and chiefly the starchy staple food-stuff in that locality. Except for premastication, there is no tradition of infant feeding with foods specifically prepared to suit the infant's digestive powers and in particular his relatively higher protein requirements.

Malnutrition does not seem to be recognized as such by the unsophisticated New Guinean. The infant who fails to thrive is usually considered to be the victim of malevolent spirits or sorcerers, of inauspicious season or other unpropitious circumstances. At the same time some women know that their milk supply is poor, and sometimes can relate lactational failure to a previous illness or other misfortune. Some foods are tabooed in illness, and some are believed to have therapeutic powers, but these rarely seem to correlate with any nutritional value. (Eggs, sometimes specially provided for sick children, are occasionally a happy exception).

Despite this, with the establishment of hospitals and the successful cure of many cases of malnutrition in infants and toddlers with essentially dietary treatment only, the important role of feeding is quickly learned by the New Guinean mother. All too often this is channelled into learning to bottle-feed an already breastfed baby, but this is another and sad story.

The love of the New Guinean parents - fathers and mothers - for their children is real and deep. Sickness in the offspring is one of the most potent motivating forces in New Guinea as in any other society. At first, the local magic-man takes precedence when it comes to treatment. But as confidence in hospitals grows, admissions of sick children take place more often, and earlier in the course of disease. Village people soon learn that certain categories of illness can be effectively treated by scientific medicine, and even by the hospital feeding regimes alone (as distinct from medicines).

There seem to be no major cultural barriers to the recognition of malnutrition as a clinical and social disease and to the introduction of measures to alleviate it. In this developing society there is generally a positive response towards public health activities, in relation to recognised needs, such as infant welfare services. Once the malnutrition problem is clearly recognised and a practical programme is demonstrated by which it may be overcome, there is reasonable hope of adequate motivation, at the village and home level, to enable preventive measures to be taken. Clearly it would be better to go a step further by integrating modified infant-feeding practices (using local resources of protein-rich foods) into the customary and traditional food pattern. The stress should be placed on 'good food for babies' rather than on 'preventing malnutrition'. But first, some detailed attention to clinical malnutrition and to practicable methods of treating and preventing it using local resources, is required.

Protein-calorie malnutrition

Kwashiorkor is one form - and not a very common form - of protein-calorie malnutrition affecting toddlers, chiefly in the age range 1-4 years, in the New Guinea Highlands. Kwashiorkor was first described and attributed to protein deficiency by Williams²⁴ in Ghana. 'Kwashiorkor' means the 'deposed child' and refers to the fact that the protein deficiency usually arises at the stage of weaning, which in Africa usually takes place at about 2 years of age, when the mother becomes pregnant again. In the New Guinea Highlands lactation is usually prolonged for 3-4 years and kwashiorkor often develops before this, since the breastmilk may supply only 2-3 g or at most 5 g protein daily after the first 12 months. The child's appetite can usually be satisfied with sweet potato and other vegetable foods, but the protein content of these foods is too low to reach the total protein requirement. Breastmilk becomes increasingly inadequate as the sole source of food beyond the age of 6 months, and consequently there is generally some growth retardation, even if not frank malnutrition. (However, breastmilk supplies first class protein not easily obtainable from other sources. Consequently prolongation of breastfeeding in accordance with existing customs should be approved and encouraged, not condemned). The supplementary diet for toddlers aged 1-2 years in the Highlands usually supplies about 6 g protein, and the total intake is about 10 g short of estimated requirements (16 g of first class protein, or 22 g of mixed proteins).



Plate 1. Kwashiorkor

The best full descriptions of kwashiorkor are by Brock and Autret²⁵ and by Trowell, Davies and Dean.²⁶ There are certain essential features, and other common accompaniments of the syndrome. The essential features are:

- (1) Growth retardation - failure to gain weight (when recorded at monthly intervals) and often actual weight loss.
- (2) Mental changes - apathy or irritability, or often both. The child is miserable and resents any disturbance, but often does not resist it actively. It grizzles and moans in a characteristic way.
- (3) Oedema - swelling, due to accumulation of fluid in the loose tissues of the body, especially the subcutaneous fatty tissue. The oedema occurs first in the feet and lower legs, but later commonly involves the eyelids, the whole face, the hands and even the whole body.
- (4) Lowered serum protein levels in the blood - in particular the albumin fraction (probably the main cause of the oedema).
- (5) Muscle wasting - especially in the buttocks; and later the arms and legs. Best seen during recovery, after the oedema has cleared.

The accompanying features include:

- (6) Skin changes - classically an "enamel dermatosis", in which the skin becomes purple and then dark brown patches form which become dry and peel off, exposing raw weeping areas like burns. These changes are most commonly seen around the groins and buttocks and sometimes spread over the rest of the legs and trunk. Quite often however, they are entirely absent; and these changes do not seem to be related to the severity or any other identifiable causal factors such as vitamin deficiencies.
- (7) Hair changes - instead of the normal jet-black wiry dense curls, the hair becomes sparse, reddish-brown or greyish-white, straight, soft and silky, and easily

pluckable or even may have fallen out naturally.

- (8) Anaemia - usually mild, but pallor of the face (especially) may be marked, because of a combination of anaemia and a decrease in skin pigmentation.
- (9) Liver enlargement - due to fatty degeneration of the liver substance (not fibrous tissue, as found in the liver cirrhosis which affects adults, and also some children in other parts of the world, e. g. India).
- (10) Digestive disorders - lack of appetite, diarrhoea.

None of the 'essential' signs is specific for kwashiorkor. Growth retardation may occur because of other illness; apathy or irritability because of other psychological or physical disorders; and oedema because of kidney disease (or rarely, heart disease or severe anaemia). The enamel dermatosis is specific for kwashiorkor but is often absent - it was present in only 10% of the cases seen in Chimbu.⁷ The skin changes in New Guineans, and also the blood protein picture, have been described in detail by Kariks.²⁷ Hair changes, especially reddish-brown discolouration, are present in about 70% of New Guinean toddlers. Severe anaemia is usually caused by malaria or hookworm or other factors. The liver may be normal in size, but microscopically usually does show fatty change.

Another form of protein-calorie malnutrition, or more strictly 'undernutrition', is called nutritional marasmus. This can occur at any age from birth onwards, and is, broadly speaking, caused by a total food shortage. In the young infant, this simply means that the mother's milk supply is insufficient. Fortunately this is a relatively rare accident in the village populations generally, but sometimes does occur, usually as a result of illness in the mother after childbirth - fever due to malaria or other causes; excessive haemorrhage; sepsis; breast abscess; and so on. Sometimes the elderly mother with 6 or more children can no longer produce enough milk. Twins are always liable to be undernourished because of inadequate total breast-milk supply.

Young infants are simply wasted and shrunken in appearance. Older infants and toddlers (aged 1-4 years) may show virtually all the signs of kwashiorkor except the dermatosis and oedema. There is a borderline group called 'marasmic

kwashiorkor' in which there is gross body wasting and a little oedema. The essential distinctions are the absence of oedema in marasmus, and the severe loss of subcutaneous fat due to caloric deficiency.



Plate 2. Marasmus

Severe wasting may be caused by various illnesses, * especially diarrhoea (which may cause rapid shrinking and wasting, due to excessive losses of body fluids in the frequent motions). Strictly speaking, nutritional marasmus means wasting due solely to insufficient feeding. However, both kwashiorkor and marasmus commonly arise following some trivial illness in which the child's appetite is impaired, or the mother withholds foods, and the appetite just fails to return, the child entering a vicious circle of poor appetite - insufficient nourishment - mild malnutrition - worse appetite - worse malnutrition.

* Including tuberculosis, but this is rare in the Highlands.

In general, New Guineans are fast learning to recognise malnutrition in children as an entity, particularly the marasmic form, aptly known as "bone-nothing" in pidgin. Children with kwashiorkor, who are not wasted, are not recognised as suffering from malnutrition, and even medical orderlies require considerable time and experience before they can really make or even accept this diagnosis.

Thus in kwashiorkor there is predominantly a deficiency of protein, and the child is classically fat and blubbery. In marasmus there is predominantly a deficiency of calories. But in both there is in reality a mixed deficiency of both protein and calories. An incidental trivial (or perhaps major) illness is often apparently the precipitating factor. Another frequent predisposing cause is some disturbance in the family situation. Death of the mother is quite common, as seen from the hospital angle; the father brings in a child who has gone rapidly downhill since this tragic event. Malnutrition actually following weaning is relatively unusual in the Chimbu, at any rate. However, malnutrition rather often does arise in families where the young father has been recruited for work on the coast and the mother finds herself worn down with care of the gardens and perhaps already a sizeable family. She receives no financial help during the husband's absence.

Kwashiorkor has been shown to respond to a great variety of diets supplying abundant energy and protein-rich foodstuffs. Protein-rich foods have even been successfully replaced by mixtures of amino acids (the building blocks of proteins) in suitable proportions. No additional vitamins are required unless there is concurrent vitamin deficiency. (Vitamin A deficiency is common in the rice areas of Asia, but is very rare in New Guinea).

The classical treatment of kwashiorkor in other countries is with bland diets supplemented with large quantities of skimmed milk. The milk usually has to be given partly as powder mixed with other foods because the quantities required can not be taken in fluid form. It may be fortified with concentrated milk protein (casein). The basic diet is usually a porridge made from rice, maize meal, bananas or other staple foods in accordance with the local feeding pattern. In New Guinea, sweet potato, bananas and rice have been used, supplemented with milk and tinned meat.

Animal fat, and especially the cream portion of whole milk, is poorly tolerated by these infants (causing diarrhoea). However, vegetable fats or oils are well digested and utilised,²⁸ and at Kundiawa it was found possible to treat kwashiorkor and marasmus effectively with the staples mentioned, supplemented with peanut foods (prepared as described below), with or without skimmed milk. These diets provide high calorie and protein intakes (at least 100 calories and 4-5 g protein, per Kg of body weight per day).

This high-protein high-calorie diet has to be maintained for at least one month and preferably for several months. The children usually eat poorly at first, and strenuous efforts are required to get them to take any food. Some like milk, and some do not. Feeds have to be frequent - at least 4 times daily and preferably more often initially. If not treated effectively, the mortality in severe kwashiorkor is very high (variously estimated from 50 to 100%), and the mortality and difficulties in treatment are just as great in severe marasmus. Blood transfusion is often of great benefit in both kwashiorkor and marasmus. With effective treatment the mortality can be reduced below 10%, but always there is a residue of sudden unexpected deaths, or gradual deterioration with incidental illness (usually diarrhoea or pneumonia) which cannot be countered despite every effort.

Successful treatment causes a rapid disappearance of oedema fluid in kwashiorkor, a restoration of serum protein levels, and rapid weight gain. The apathy and irritability disappear, and one of the earliest signs of good progress in treatment is increasing alertness and a willingness to smile. Gains in body weight are at several times the rate in normal children of the same age or weight. The fatty degeneration in the liver resolves more gradually, over a period of months. Some permanent retardation of skeletal and even of mental development may occur.²⁹

Various vegetable protein-rich foods have been used for the treatment of protein-calorie malnutrition, especially in India and parts of Africa and some Central American countries. In India various locally grown pulses (legumes) have been used: some dhalls (Phaseolus, Cajanus, Dolichos and other species) and soya bean and peanut preparations. In Africa similar pulses have been used, and groundnut flour; cottonseed oil was used to supply additional calories in Uganda.²⁸ In Guatemala a scientifically

evolved and tested mixture of locally available cereals and cottonseed and sesame flour is being produced commercially (known as Incaparina) at a price well below that of skimmed milk. It is suitable for the treatment of malnutrition, and also as a general item of the diet. However technological development, agricultural products and purchasing power in New Guinea would not permit the production and consumption of Incaparina itself in New Guinea as a regular infant food. In our Territory it appeared that the peanut was the most widely available and popular protein-rich food grown (in the Highlands in particular). The aim of the nutrition research programme was to find some locally-grown protein-rich food which was nutritionally satisfactory as a 'weaning' food for babies, was culturally acceptable and agriculturally possible at least throughout most of the Highlands.

Peanut feeding for hospital children

Peanuts were therefore selected for initial study in the nutrition research programme begun in Kundiawa in 1961.

After some trial and error, the most satisfactory method of feeding peanuts was found to be as peanut butter, home-made from locally grown peanuts in the following way. Mature sun-dried shelled peanuts are baked to a light brown colour in a warm oven, and left for a few hours (e. g. overnight) in the oven after the fire has gone out, so as to be thoroughly dried out. They are ground once (twice if not properly dried out) in a Beatriz Corn Mill,* now retailed at £A2. 12. 6d. in the Highlands. Peanut butter could be made with a household mincer by several grindings of baked peanuts - usually 10 or 12 times - but this was too tedious for general application.

Actually peanuts had been used for some years for infant feeding in the Baptist Mission Hospital at Baiyer River in the Western Highlands.⁹ There, lightly baked peanuts were ground with an ordinary mincer into a coarse flour, which was fed in rather small quantities to malnourished infants and toddlers. This pioneer work was done by Sister Crouch. She had been encouraged in the late 1940's to try peanuts or other locally-produced protein-rich foods as milk-substitutes, by Dr. Joan

* Manufactured in England by John Harper, Willenhall, Staffs.

Refshauge, Director of the Maternal, Infant and Child Health Division of the Department of Public Health. Sister Crouch made the useful discovery that peanut flour was better tolerated when fed with mashed ripe banana than with sweet potato or other foods.

In hospital practice the advantages of peanut butter were -

- (1) peanuts could be grown and prepared locally;
- (2) it was often more acceptable to infants and toddlers than milk;
- (3) bacterial contamination, leading to diarrhoea, was less liable to occur than with milk, especially when bottles were used for the latter;
- (4) it could be kept - for several months at least;*
- (5) in a small bulk it supplied a relatively large amount of protein and calories;
- (6) it could be pressed into egg-sized balls which the child could hold in his hand, and eat piecemeal.

Various recipes were tried and the most popular proved to be the sweet potato/pumpkin/peanut mixture (for infants aged over 6 months only); peanut butter balls (for infants over 6 months), alone or put inside a banana or sweet potato split lengthwise - the 'peanut-banana split'; and peanut butter mixed with mashed ripe Cavendish banana (equal parts of each) for infants under 6 months. For very young infants (under about 4 months) this peanut-banana mash should be mixed with a little water to a semi-fluid consistency. The peanut-banana mash

* Eventually it becomes rancid. This could be prevented or delayed by adding 1½% common salt. However, in practice the problem is not how to preserve, but how to prevent the consumption of a given quantity all at once. The additional expense and trouble of adding salt is considered unnecessary. Bacterial contamination during short-term storage does not appear to be a problem in practice.

was fed by the mother, with a teaspoon or her finger.

It was established, by gradually extending peanut butter feeding to younger and younger infants, that it was well tolerated - and very well liked. Whole peanuts and coarsely ground peanuts were fed to adults and older children (with teeth) and considerable amounts of whole or fragmented nuts were found to pass through the intestines unchanged, being recognisable in the faeces. The fine grinding into peanut butter with the Beatriz Corn Mill is probably the reason for the absence of diarrhoea, which had bedevilled earlier trials with peanut foods in various places.

During 1961-62 an attempt was made to assess the value of peanut foods, prepared as described above, in the treatment of malnourished children.⁷ Attention was concentrated on marasmic children over 6 months of age. They were treated with peanut foods only, or skimmed milk and peanut foods; and a few with skimmed milk only and a few with ward diet (sweet potato and vegetables) only. All the children (except the motherless) were breastfed.

It was not possible to establish exactly identical groups for comparative purposes. The 4 children on the ward diet all went downhill, one developing kwashiorkor, and so this purism was abandoned. Adequate comparisons were possible between the peanut-only and peanut + milk groups, numbering 51 and 60 respectively. Progress was assessed in terms of weight gain and increase in serum protein levels. There were no significant differences in response between the dietary groups.

Several breastfed children with kwashiorkor were also treated with peanut foods only, and the general response and disappearance of oedema were as good as in the peanut/skimmed milk group. Breastfed infants below 6 months also showed the same response in the different dietary groups.

'Nitrogen balance studies' were also carried out on a few malnourished and a few healthy children. In these, the total nitrogen intake in the food, and the output in urine and faeces, were measured, and the absorption, utilisation and digestibility for the foods were estimated. Incidentally, it was found that consumption of plain peanut butter gave the highest actual protein and calorie intakes, rather than any of the mixtures.

The results of all these clinical trials ⁷ indicate that peanut foods are reasonably well utilised, and that they are effective (either alone or together with skimmed milk) in the treatment of malnutrition in breastfed children.

Initially, because of traditional infant feeding practices (or rather, the lack of them!) it was difficult to persuade mothers to feed any foods to young infants. However, as the routine became established at Kundiawa, the benefits of peanut feeding were readily apparent to the mothers. They became willing to feed peanut foods earlier - before the eruption of the first teeth, and eventually parents would come to the hospital asking for admission so that their young infants could receive peanut foods. Peanut feeding became a self-advertising programme.

Peanut feeding for village children

To establish peanut butter as a regular infant food in villages, clearly it is essential that peanuts be grown in the village and not supplied as a government hand-out. Every village mother with an infant aged from 6 months to 2 years should grow and process peanuts for peanut butter, using a suitably located and supervised grinder.

It is not argued from the results summarised above that peanut protein is just as good as milk protein. However, since in most cases peanut foods can effectively cure malnutrition, their timely use at the village level should usually be able to prevent it.

In villages, it has been found suitable to bake peanuts by placing them on a sheet of metal or in a dry frypan or billycan about one foot above a smouldering fire, for 2-4 hours.

The quantity required as an effective supplement is estimated at 10 g protein* daily. This means one pound of shelled peanuts fortnightly or 26 lbs per year - equivalent to about 40 lbs peanuts in the shell. Production in the Highlands is estimated

* Peanut butter contains 30% protein, i. e. 1 oz. peanut butter is required daily.

by the Department of Agriculture, Stock and Fisheries³⁰ at 1120 lbs per acre. * The total amount of land required is therefore less than one twentieth of an acre; actually, a 40' x 40' area. Even an amateur gardener was able to grow much more than this in his spare time in his Kundiawa back-yard! This quantity could in fact be grown at one planting, or in successive round-the-year plantings. For instance, 4 small areas of the customary 10' x 10' could be planted every 3 months. If a proportion of the nuts is to be sold and/or used for consumption by the rest of the family, a correspondingly larger area would of course be required. In the past, D. A. S. F. has arranged that villagers shell the peanuts after harvesting them, and D. A. S. F. purchased as a cash crop only the superior (larger) nuts, leaving the inferior nuts (about half of the crop) for village consumption. These should be sufficient in quality for making peanut butter. Promotion of peanuts as a cash crop could react detrimentally to the promotion of peanut butter as an infant food. However, sufficient quantity could still be made available, by planting double the area mentioned (and a small additional area for seed, and perhaps an equal area again if required for consumption by the whole family). Competition with other crops for available land is discussed more fully by Brookfield and Shand.

If storage for long periods is required, the dry nuts could best be kept in the shells, inside hollowed bamboo poles or woven pitpit baskets, sealed to prevent access by children or rats. Such containers are already in use by villagers for storing seed etc. They could be opened one by one as required. Similar containers could be used for storing shelled peanuts or peanut butter.

The next vital question was where best to locate the Corn Mills.

A limited supply of grinders was available. It was decided to place one of these initially in each of the hospitals in the Highlands, so that peanut foods could be used routinely in the treatment of malnutrition, and so that hospitals could be effective demonstration centres of the method and value of infant-feeding

* Virginia Bunch is the variety strongly recommended and promoted in the Highlands by D. A. S. F.

with peanut butter. The planting of large peanut gardens at all Highlands hospitals is necessary to prevent the hospitals from becoming major peanut purchasers. (These peanut gardens are in themselves a useful advertisement for the peanut-butter infant-feeding project, besides supplying the peanuts for all hospitalised malnourished children).

Although peanuts as a crop are planted and harvested by the women, the men are responsible for allocating the available ground for the different agricultural purposes, which are in a sense inevitably competitive.

It was clearly important therefore to persuade the men that peanuts should be planted and grown; and moreover, that the crop should be earmarked specifically for infant and toddler consumption, unless a sufficient excess could be grown for the whole family to eat, or for sale.

It was felt that the best approach would be through Local Government Councils (L. G. C.), whose members should be, if anyone, the people best able and eager to give a lead to the community. From the inception of the nutrition research programme, the Waiye L. G. C. , (5 miles from Kundiawa) had been kept informed of the nature and purpose of the work being undertaken in the hospital and in the village surveys. Now that a practical remedy was to be put forward, demonstrations and discussions were held, concentrating particularly on the Council area.

A detailed pilot study in one area was required; an assessment of the practical, cultural and agricultural problems at the council, village and home level. These were studied by Mr. and Mrs. Ross who lived in the village at Mintima (in the Council area) from July, 1962 until July, 1963. Through their good offices the co-operation of the Waiye Council has been consolidated, a peanut-planting programme planned jointly with the Council has been initiated, and peanut-grinding clinics established in the area for mothers with infants.

Grinders, purchased by the Waiye Council, are now established permanently at each of the Aidposts in the Council area, and extension into the adjacent Kerowagi area (Koronigl Council) area is under way. In the latter area, grinders may

be looked after by each political clan represented in the Council, rather than by Aidpost Orderlies.

Considerable supervision of the use of the grinders is required initially. They need to be firmly bolted with wing nuts to a solid supporting bench or plank. The operator needs practice to adjust the grinding plates tight enough to produce a smooth paste, but not so tight as to cause breakage of the handle or shaft of the grinder. Screw-threads are apt to be stripped by those not brought up with these common-places of our civilisation. And finally, a daily cleansing cannot be taken for granted.

A further factor of importance which has come to light as the plan evolved was first seen at Gumine, one of the patrol posts in the Chimbu Subdistrict. In the middle of 1962 the hospital there was taken over by two of the first indigenous Medical Assistant graduates from the Papuan Medical College. Their enthusiasm in establishing infant-feeding with peanut butter in the hospital, and in promoting it in the course of patrols in outlying villages, was exemplary. Mr. Temgwe's contribution to this symposium was invited in recognition of this work.

Experience thus far does indicate at least one practical answer to the need for a protein-rich weaning supplement for Highlands infants. It is not claimed to be the only possible solution, nor that it will prevent every single case of malnutrition. However, the popularity of the regime is such that the limiting factors in its spread may be the availability of grinders and Virginia Bunch peanut seed, rather than other cultural, agricultural or economic factors. Peanuts can be grown in most coastal areas as well as in the Highlands, but there is an altitude ceiling somewhere around 6,500'. Above this ceiling another solution may have to be found (or possibly varieties of peanuts which will thrive in the cooler conditions). It may be possible to exchange other subsistence crops for peanuts in higher-altitude localities, or to purchase them with cash from sale of other local produce. Soya beans and peas are other subsistence possibilities, better suited to higher altitudes. Another approach to the problem, currently under investigation, is the production of improved varieties of sweet potato, containing more protein.

Is there a reasonable prospect that there will be adequate motivation in Chimbu society, and perhaps elsewhere in New Guinea, not only to overcome the practical difficulties and to solve the clinical nutrition problem in one or all of these ways, but also to integrate into customary food patterns an altogether new pattern of infant and toddler feeding?

Table 2

Causes of death in Kundiawa Hospital

Causes of death	Infants 0-12 mos		Children 1-17 yrs.		Adults 18 yrs. and over	
	N	%	N	%	N	%
Cirrhosis of liver and related diseases			3	2.8	29	33
Malnutrition	1	.8	3	2.8	3	3.4
Kwashiorkor			3	2.8		
Anaemia			8	7.5	1	1.1
Dysentery	1	.8	13	12.1	6	6.8
Gastroenteritis	13	10	9	8.4		
Pneumonia and respiratory diseases	78	60	40	37.4	11	12.5
Meningitis	2	1.5	7	6.5	5	5.7
Nephritis			1	0.9	6	6.8
Whooping cough	16	12.3	7	6.5		
Malaria, cerebral malaria			6	5.6	5	5.7
Tetanus					2	2.3
Bowel inflammations, peritonitis			1	0.9	3	3.4
Cardio-vascular diseases	2	1.5	1	0.9	4	4.5
Cancer					2	2.3
Pregnancy and childbirth					4	4.5
Prematurity and congenital defects	15	11.5				
Accident and violence					4	4.5
Other	2	1.5	5	4.7	3	3.4
TOTAL	130	99.9	107	99.8	88	99.9

Notes

1. Data from Death Certificates

Period covered: Infants 1962 and Jan-Sept 1963; Children 1961, 1962 and Jan-Sept 1963; Adults 1961, 1962 and Jan-Sept 1963.

Patients from all over Chimbu Division, Eastern Highlands District, New Guinea.

2. The deaths in Kundiawa hospital are a very small proportion of deaths in the area. Unfortunately we do not know what selection there may be in bringing cases to the hospital or the causes of death outside the hospital. A morbidity survey now in progress by Dr. Vines and his team is expected to throw light on this question.

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Discussion (following Dr. Bailey's paper)

Unknown: At what stage do the changes that occur in malnutrition become irreversible?

Bailey: Malnutrition is not beyond repair at any stage. Even the most desperate cases can be rescued with vigorous treatment in the hospital. Some permanent retardation (physical and possibly mental) does occur in the most severely effected infants, but recovery from serious malnutrition is so good with adequate treatment that it is very difficult to detect a previous episode of severe malnutrition.

Unknown: If you solved the problem of infant malnutrition what means do you see for keeping malnutrition in adults at bay?

Bailey: In adults, nutritional requirements are relatively much less than in infants, and the daily diet of adult New Guineans seems to meet most of the protein needs. However, this may not be true for pregnant and lactating women, and the possibilities for using peanuts or other protein rich foods during a pregnancy and lactation are under study, and would need to follow up such a programme as the present one.

Dr. Muriel Bell: Are the peanuts free from the Aspergillus favus toxin?

Bailey: Apparently yes. As far as we are aware there has been no ill effect from the peanut feeding that has been going on for two years under close supervision.

Mrs. Winnifred Garran: In the early days of peanut feeding in New Guinea there was some fear by Infant Welfare Sisters, that the high fat content of peanuts might upset the infants digestion.

Bailey: Recent work in Africa has shown that the intolerance to fat is essentially towards animal fat rather than vegetable fat. The fat in properly prepared peanut foods does not cause any intolerance in most infants.

Unknown: Has there been difficulty in keeping the

mothers of babies with Kwashiorkor in hospital? My experience in Uganda was that after the initial improvement the mothers tended to go home with the children and any benefit gained in hospital was lost.

Bailey: This problem does occur in the Chimbu. In 1961 and 1962, 51 children with Kwashiorkor were admitted to hospital, and about 10 of these returned home before they were supposed to. One of these subsequently died in the village, but the remaining 50 were still alive and well some months after discharge. Generally the infants stay for 2 to 3 months in hospital and only a minority go home earlier.

Unknown: What are the main factors limiting the use of milk powders in the Chimbu area?

Bailey: It is a very good culture medium for bacteria and unhygienic handling in the village home makes milk mixtures risky at the present stage of development. Moreover, milk in any form is an imported product and the aim of the programme in the Chimbu was to find a product that the people could provide for themselves.

Unknown: Are there any protease inhibitors in peanuts?

Bailey: If you are referring to trypsin inhibitors, not in the cooked peanuts.

Unknown: One could have too much emphasis on a particular form of protein. Where peanuts are grown on a large scale disease might wipe out the crops. Should not other sources of protein be investigated?

Bailey: In principle your comment is correct, but we found it difficult enough to interest people in peanut feeding. Diversification would lead to more difficulties. Further work should be done on other available foods, but it seems more important to provide more protein in any form, rather than concentrate on quality of the particular protein. Any locally producible legume or other safe protein source would be suitable if local circumstances enable it to be consumed.

Goodbye to all that?

Paula Brown

(Australian National University, Canberra)

We have been told that serious nutritional inadequacies occur in 3% of Chimbu babies. Dr. Bailey's efforts at cure and prevention of malnutrition have been described, and other speakers will have more to say about the introduction of peanuts as infant food. I have no special knowledge of nutritional problems in Chimbu or elsewhere. My aim is to present a general picture of the Chimbu, their history and social development, and I shall later comment upon the place of the peanut program in this.

Until the 1930's the centre of New Guinea was thought to be an uninhabitable mountain mass. Then great fertile valleys were discovered, inhabited by hundred of thousands of gardeners, living in larger communities than the Melanesian coastal peoples. The Chimbu valley is one of these. In thirty years the Chimbu people have learnt to use new steel tools; they have begun to grow and process agricultural products for sale; and young men have worked as labourers all over the Territory of Papua and New Guinea. They have seen the introduction of rudimentary medical services, missions, schools, agricultural extension, a police force, a judicial system, and local government councils. Young people have grown up in the security afforded by the government suppression of warfare, but the elders retain vivid memories of the days before the white man came, and most of their traditional beliefs and practices survive. In the five years that I have known the Chimbu of Naregu tribe they have passed through a spurt of developmental enthusiasm, entered a semi-cash economy, been disappointed in their rewards, and some have begun a movement of reaction. But these more recent phases and moods must be related to their traditions before their significance can be discussed.

We have no information about early highland culture, and we can only guess that for several hundred years the people have been using polished stone axes, wooden spades and digging sticks to grow sweet potatoes and a variety of other crops.

Long before this, with a smaller population, they must have been hunters and collectors of food; and then I presume a simpler form of agriculture, perhaps with a different staple crop, preceded the present complex form. As subsistence production increased, the forest was reduced and wild products were largely replaced in the diet by cultivated plants, pandanus trees (for nuts and oil), and domestic pigs. Population density in Chimbu is the highest in New Guinea; the Chimbu have spread from their narrow valley in all directions, competing with one another and neighbouring peoples for land.

Although Chimbu population density exceeds 400 per square mile in the valley, there are no towns and no central government. The largest political units are tribes of a few thousand people, composed of largely autonomous clans, themselves segmented into subclans, local groups and families which are independent for nearly all purposes save occasional ceremonies and warfare. Houses are scattered throughout the tribe's territory and the people are free to follow their own interests. Land and livelihood were subject to raids and destruction by enemies, and nearly every group can recite a long tradition of military losses and forced migration in search of new land with some hope of security.

Even now we have no accurate demographic, fertility or mortality data on Chimbu. It is unlikely that many deaths occurred in battle, but crop destruction in warfare probably contributed to nutritional deficiencies, and the general conditions of squalor and lack of medical knowledge must have been factors in the high death rate which characterizes all New Guinea highland people. We can only conclude, by considering traditions of migration and expansion, and the extensive use of land for gardens, that the Chimbu have been a growing population. Why they should seem to have expanded more than most other New Guinea highland people is a puzzle. Diet is similar throughout the New Guinea Highlands, warfare is common, and except for kuru (limited to the fore and neighbouring groups) no genetic or physical differences which would account for this have been reported. Nutritional deficiencies were noted in Chimbu by a perceptive medical officer some years ago and work has been concentrated there mainly because of the size of the population and of Kundiawa hospital.

The Chimbu are not tied to the struggle for existence. They set a high value on display and distribution of goods. Their festivals and all gatherings to celebrate birth, puberty, marriage and death involve the distribution and exchange of valuable goods and foodstuffs - including ordinary subsistence foods, rarer special foods, and delicacies such as oil, pigs and nuts. Both the size of the display and the proportions of the more favoured foods are sources of pride and prestige. Chimbus harvest nuts and rear pigs mainly to give to others; their own consumption of these depends largely on what they receive. Both men and women cultivate food crops for distribution as well as consumption, and nowadays for sale also.

Some of each family's foodstuffs are distributed; there is a circulation within the community. Some production is exported - that is, exchanged for feathers, shells, axes and other goods not available in the Chimbu habitat. These items, once acquired circulate in payments and ceremonial distributions.

This intense exchange activity is extraneous to subsistence needs: some food is wasted, and much time and energy is expended beyond subsistence production and consumption. The Chimbu have plenty of leisure for ceremonies, fighting and exchange. And these are the activities which give them their greatest satisfactions - a display of food, a fine line of feathered heads at a dance, the routing of an enemy.

Every married man has his own land and property. Most subsistence work can be done by an individual or a family. Each person is in close relations of mutual aid with others in his local group and has ties with relatives living elsewhere, but he can choose his closest associates from amongst his kinsmen and clansmen, and can visit or join a more distant relative if he wants to. Participation in the larger activities is the result of many individual decisions to join in the business at hand, not through organization. A few of the activities, especially large ceremonies, require planning and coordination of effort, but there is no permanent organization or authority to draw individuals together or compel cooperation. Each individual and small group defended its own territory and built up its own prestige: it joined with others occasionally for defence and attack.

The Chimbu before 1933 were skilful cultivators and pig raisers, exuberant and uncontrolled fighters - an early Patrol Officer wrote 'They Fight for Fun' - and they took pleasure in display and exchange. Their religious beliefs, cosmology and artistic skills were little developed; their energies went into competition and bombast. These traits can be seen in their adjustment to a changing situation. Until 1933 they had little trade contact with people outside the highlands. Then they saw their first cloth, metal, and white men. Thirty years have brought many changes, but they are not enough to transform the culture.

Chimbu's first interest in the white man was for his cargo. The killing of two missionaries was incidental to this - the people were bold in their attempts to take what they wanted. They were intensely curious about Europeans. Pacification was the first administrative task, but tribal fighting persisted as the main remedy for grievances. Soon headmen were appointed - they were expected to bring disputes to court so they did not become violent.

From 1935 a Patrol Officer was stationed at Kundiawa to control a large area and a population of about 200,000. Gradually, all areas were visited and some census work began. Berkshire and Tamworth pigs, and a number of European vegetables (cabbage, tomatoes, soya, peanuts) were introduced. The supply of goldlip mother of pearl shells, important as decoration and a part of ceremonial payments, increased, and knives, axes and spades were widely used. Administration officers destroyed weapons when fights were broken up. The ceremonial life continued; payments and decoration increased with new goods and the absence of destruction and interference through tribal warfare. Medical work began and there was a school for a brief period in about 1939. Missions were established and began some medical and educational activities.

During the war ANGAU, the Australian New Guinea Administrative Unit, took charge, attempting to keep communications in order and stop epidemics. The rapid succession of officers before and during the war, each with his own aims and concerns, could not but confuse the natives: first one settled tribal boundaries, then one punished those who did not maintain latrines, another tried to catch every murderer, the next kept

people at work building roads and another urged reafforestation. When the Officer-in-Charge was withdrawn in 1946, tribal fighting was again widespread.

The first twelve years of Australian administration introduced some technological changes and restricted fighting. Chimbuses realised that the administration was interested in peace and developing communications by extending roads. The sole officer was a Native Affairs man. There was no real effort towards medical improvement, elementary education, economic development, and no change in living standards or hygiene.

During the next fifteen years or so, since the re-establishment of civil administration, there has been a slow growth in administrative staff and services: the establishment of a few primary schools, a hospital and Aid Posts thinly scattered throughout the rural area, agricultural extension work, recruitment for labour on coastal plantations, a police station and an increase in Native Affairs staff. With peace throughout the highlands, Chimbuses move over great distances to work on coffee plantations and as domestic servants, to trade in feathers and shells, and a few have taken up independent enterprise as gold miners.

But all of this is extremely limited. There is still only one doctor for 160,000 people in the Chimbu Division. I was not able to obtain figures on the proportion of children in school. Many tribes have nothing but mission catechism schools taught by men with only primary schooling themselves; in others the government primary school may take as many as 20% of the 6-10 age group, but a tiny fraction of these can find a place for Standard 4 and beyond. Boys are frequently dismissed from school for bad behaviour; continuation of schooling seems to depend upon docility and good attendance. Now a few children have reached a standard in mission or government schools preparing them for a secondary school or training in a trade, but there is nowhere for them to go: they are neither selected by ability nor guided into fields appropriate to their interests. Adult education is so far unknown. Motivation is not lacking: the people very badly want the skilled positions of the area - clerks, carpenters, drivers, mechanics - to be held by their own people, and the youths are intensely interested in training programs. Sent back to the community, with neither reading materials nor opportunities to use their knowledge, they quickly forget it. I

am not surprised that there are only two or three adult Chimbus literate in English, but think it is a matter for concern that children now ten years old have finished their schooling at Standard Two or Three in a government school or at no standard at all in a mission school.

When coffee came into production several years ago, the Chimbu were very optimistic: they thought they could soon obtain the wealth they saw Europeans enjoying. Coffee has increasingly been the chief cash crop in central Chimbu, but care of coffee groves, processing and marketing are little supervised, and the natives usually receive the lowest price for the poor quality of their coffee beans.

Money has entered the economy. Everyone is accustomed to buying and using the wares of local shops - a few foods, clothing, enamelware and simple tools. They also now pay tax, court fines, and buy fowls, dogs, cattle and pigs from one another and from missions and government. But there is no general comprehension of monetary value. While wages as labourers for Europeans remain near the minimum of 30 shillings a month, chickens are priced at £1, annual tax is £2, they hand over £100 in cash at marriages, large amounts of money change hands in card games, and £10 was recommended as the membership fee in a cooperative society. The people imagine that the income of about £3-4 per quarter for road maintenance by a group of several hundred people will permit group outlays on feasts, marriage payments, and even a Land Rover. A single party recently cost about £800, mainly paid by one large coffee grower with contributions by many others. Conspicuous display in ceremony and exchange have increased although traditional rituals are declining. There is pride in lavish outlays for celebrations, and in council buildings of timber with iron roofs, but little understanding of prices and values.

There is no sense of urgency: waiting is a common use of time for Chimbus. When a man is invited to receive a small piece of pork from his cousin, he arrives before noon and waits until 3 or 4 p. m. for his portion. He may wait several days at the government station before an officer is free to deal with his case. He will walk all day to visit a relative, and return home a day or two later. A trip to the Aid Post or hospital clinic is normally a full day's excursion, including a long walk and a wait

for attention. The one day a week nominally given to road maintenance begins at 9 or 10 and continues to 11 or 12, followed by a little domestic work such as the gathering of firewood. The sale of a few pounds of coffee beans requires a wait of several hours for the buyer. The same generous allocation of time is found in their own ceremonial life: several days are given over to marriage negotiation, then a day for cooking pigs, the next to carrying the pigs and the night to lecturing and singing to the bride, the next for the ceremonial payment and taking the bride to the groom's house, and another day for a vegetable exchange about a week later. Although women do some gardening, harvesting, carrying and cooking every day, men devote a full day to a specific garden or construction task.

Meetings are called often, and every meeting fills a day. From the night before or early morning the hills resound with shouts to assemble. By ten o'clock a few have drifted in, and calls increase in frequency. The government officer may come at any time now, or the local people may themselves get under way by noon. The meeting may last only an hour or so, but there is no likelihood of any other productive activity that day.

Chimbus do not face this use of time with impatience - it has always been this way, and the regular work hours of employed labourers and men in prison are regarded as severe. Plans and programs are vaguely extended into the indefinite future. No seasonal variations require a strict agricultural calendar. A pig feast is announced years before the preparations are completed. House sites are marked out and some material gathered, but it is often months between the successive stages of construction.

Until 1959 the system of appointed officials - Luluais and Tultuls - adopted throughout New Guinea for native administration was used in the area. Since 1959 three Local Government Councils have been established, but these include only a fraction of the Chimbus. Councils can be a dramatic step towards local government: a group of former enemy tribes are joined together, officials are elected and participate in regular meetings, supposedly planning community development. The Council collects taxes and allocates its income. Yet councillors are only the local leaders - perhaps progressive in ideals, but uneducated, and untrained in formal procedure, budgeting, or the

powers of a Council. After four years the members of Waiye Council do not yet know what matters can appropriately be discussed and acted upon by a Council; they make proposals for current expenditure months after the annual budget has been voted; some matters are raised repeatedly, with no solutions proposed; at nearly every meeting councillors complain that they do not have the authority they would like to accomplish their aims.

In practice the Council is used by the administration as a multi-purpose body. Councillors are given many of the functions of the old native officials - to communicate directions and bring people out for public works. As elected officials they are assumed to represent the wishes of their constituents (as in the amount of tax to be assessed), but they are often called upon to speak on matters which are entirely new to the people, for example, the proposed repeal of the Native Women's Protection Ordinance, of which the Councillors and their electorates have never heard: their reply was - it would be a good thing if we had such a law. The Council is, indeed, a convenient forum for all officers - medical, educational, agricultural, police and native affairs: they speak for a few moments to the Council meeting, informing councillors of changes and developments, and then trust them to inform their constituents; or they ask the Council to provide funds for the improvement of Aid Posts and schools, train an agricultural worker or haul logs for bridge reconstruction - all services otherwise provided by the administration.

The Chimbus immediately developed a taste for European goods and depend upon the government to provide the means of attainment. For they have no other source of information or stimulus, no chance of independently learning of new possibilities. Chimbus are not prevented from entering new activities by a restraining social structure or by repressive beliefs. Every man can work, sell his crops or labour, trade, and become a leader. Training and sources of information are the limitations, not land shortage or natural resources. The people realize that they are almost entirely at the mercy of the administration.

Chimbus really have nothing to offer but their labour. They have long been the recipients of directions. At first this was determined by a single Native Affairs Officer - his patrols to

establish law and order, his orders for road work. In the past ten years, and increasingly in the past five years, these have been multiplied by the separate services of Departments of Education, Agriculture, Public Health, Police and judiciary demanding the attention of natives and their labour. People are called upon to prepare a garden for the Aid Post orderly, build a dining room for the school, listen to the coffee extension worker, help the councillor build a house. The mission, too, requires assembling for prayer, work on school and hospital buildings, and money contributions. Inevitably, some of these demands conflict - not merely church and state, but health and agriculture, politics and education. Can we expect the Chimbos to adapt to these demands?

Chimbu adults can perhaps be loosely divided into several groups, distinguished by age and experience. The oldest group were adults in the 1930's; their early experience was in the unstable conditions of traditional life - illness attributed to mysterious causes, treated by herbs or sacrifice; constant danger of raids, theft, fear of travelling beyond the bounds of friendship. When we drove on a new road through the territory of several neighbouring and formerly hostile tribes, and reported this trip to an old man, he said that he would be afraid to go among such dangerous strangers; the expanding range of young people amazes their elders. These older people saw the first Europeans and their goods when they were already mature - they were asked to stop tribal fighting and submit to Australian administration. They have gone to missions, used new tools, eaten new foods, put on clothes, built slightly different houses, sold vegetables and grown and processed coffee for sale. They use money, pay taxes, vote for the Local Government Council and the House of Assembly. One or two of the most adaptable have remained local leaders, become entrepreneurs in new contexts. They vividly recall the battles of their younger days, and they continue to plan and organize the ceremonies which remain a focus of interest. But Chimbu has never been dominated by a gerontocracy, and most of the older men have retired from active leadership. Until the establishment of the Local Government Council in 1959 men of this type were the backbone of Administration - the Tultuls and Luluais who mobilized people for government sponsored public works and took troubles to the government office for settlement. As they aged and died, they were replaced by younger men who per-

formed much the same functions, perhaps with greater vigour but rarely with greater understanding of the purpose of Administration.

The men who were children in the 1930's saw and heard about tribal fights, but most of their lives have been under Australian Administration. Only a few of them have had even a little mission schooling, but many served as labourers and carriers during the war and have had a glimpse of places outside Chimbu. Some have been policemen and interpreters - giving more contact with government aims. These experiences instill an awe of European ways, an impression of wealth and skill without any understanding of the processes of production. They are, I think, the basis of cargo belief. An attitude of mystery surrounds the white man's things for such people. Our discarded bits of tin and broken parts of primus stoves were eagerly taken by people of this group and preserved as specimens of white culture. After many years of life on the main Highlands road, they leave their work to gape at passing cars. Whenever a plane lands at Kundiawa (now several times a day) a crowd gathers to look at it, and I have often seen people gingerly feeling the metal of a Land Rover. Men of this group use money with little notion of its value, and are most influential leaders in present enterprises. The Member of the Legislative Council for the New Guinea Highlands (1961-64) and perhaps half of the Councillors are of this group.

The next younger group has been born since the arrival of Europeans. Most of them have spent some time in some sort of school - mostly mission schools taught by semi-literate catechists. They attend church fairly regularly, have used European medical services, have been familiar with metal tools since childhood, and have a few technical skills - building with nails, coffee processing. Perhaps most of them have spent some time in employment under Europeans as labourers on plantations or as domestic servants, but these skills have little place at home. They speak pidgin English and can count their losses and winnings at cards. Sometimes they become impatient with their elders, but many enthusiastically joined in the preliminaries for a traditional pig feast in defiance of another faction's urging that efforts be concentrated upon economic development. Their values are confused - they are half committed to a new way of life without an educational or economic foundation

for it, and they see that traditional ceremony provides excitements lacking in the new activities.

It is only a few of the youngest adults who can be considered literate - who have had some years of schooling and understand some English. Occasional favoured boys in the late 1950's were selected for training as teachers, carpenters, medical orderlies, etc. by mission and government. Now of course there are some youths in training or in secondary schools in other parts of the territory who may return with a genuine understanding of Western values and technology. Any such training has much to contend with. Perhaps the most educated man in his 20's in Naregu, a carpenter's assistant, told me a few months ago that he had always accepted the teaching of the church and his school teachers about sorcery, but that he had listened to a sorceress' story about her powers and spirit helper, and he believes her now.

Women, even under thirty, live a more traditional life. Far fewer of them have been to school at all, or had any experience outside the area. Their outlook more closely approaches that of men who are older and have not travelled. Their days are mostly spent in gardening, cooking and caring for pigs and children. They have fewer clothes, and they are washed less frequently. Before they had cloth, Chimbu skins were protected from the cold by a layer of pig grease. If this is to be washed off, it must be replaced by suitable warm clothing. But the women are not opposed to this. A woman's club was recently organized and has been very popular: women regularly contribute the shillings they earn by selling vegetables so that sewing machines can be purchased, and there was great competition for places in the sewing class. But I fear that it will be many years before women and children are clean and warmly clad.

Housing is a serious problem. Chimbu houses are low wood and cane structures, earth floored, thoroughly charred by a fire whose smoke filters through the thatch; occasionally there is a platform bed, mats or blankets, and a few garments and tools are stored there. Half of the woman's house is used by the pigs. It is infested with rats and fleas, often malarial mosquitoes, and the inhabitants usually have worms and scabies. The conventional practice of pig husbandry involves feeding pigs

in the afternoon, and frequent afternoon rain encourages sharing a house with the pigs. A low earth floored house with a constant fire is well adapted to keeping pigs and unclothed people warm on highland nights. It is not suited to clean clothing, uncontaminated food, coffee processing, or homework. A lighter, raised building with proper storage places would require different materials, insulation, another type of fireplace for cooking and many blankets. Some men now use native bush materials for a different style of house, and have higher houses where their belongings keep clean, but to live in such dwellings they must have some technological help and be able to buy blankets and stores. Domestic habits and siting of houses are both involved, as the pigs must still be fed and housed, and the women are most concerned in pig care.

Improvement in hygiene and better housing have not been actively promoted by any service in New Guinea. It is a matter requiring joint consideration by medical, agricultural and native affairs officers, and sources and costs of materials are involved. A general educational program would be needed. As we have seen, change in Chimbu has been piecemeal, and housing and standard of living are not the responsibility of any one service.

What can all this have to do with peanuts - or rather with the introduction of a specific food, peanut paste, as a part of the regular diet to improve nutrition of infants and young children? How shall Chimbu habits and attitudes change? It is easy to see that they have the normal range of human intelligence and that they can learn new techniques. But traditional habits persist, and only coercion or genuine learning that another method is superior can change them.

Papua-New Guinea has a high infant mortality. Chimbuses do not want their babies to die, but they are not preoccupied with health problems. And they do not see that their traditional methods of child care are inadequate. Once several years ago I saw an Infant Welfare sister ask the mother of a puny Chimbu baby to go to the hospital for supplementary milk. The mother replied that she had several children - all had been small infants but are healthy and grew well later. No, she would not get a milk supplement. Is she any different from the ordinary housewife elsewhere in the world?

Chimbuses have seen that European medicine can some-

times cure illness, but they do not understand the causes of health or of death. To participate in the peanut program they would have to take the results on faith, and it is not so simple an adjustment as it might at first appear. It requires planting on a regular schedule, harvesting on schedule, cooking, grinding, storing and setting aside - all new to Chimbu mothers.

Chimbus like nuts and grow them for food and for sale. But planting of all vegetables is a rather casual affair. When the garden is prepared - and almost any other activity may take precedence over garden work - the planting materials are brought in and planted bit by bit. Planned peanut production for infant feeding hardly fits in with this pattern.

There is nowhere in the culture a foundation for such a practice as the regular addition of peanut paste balls to the infant diet. Babies are nursed frequently but not on a time schedule; children munch snacks at any time and share in the family meals. Food is not stored; the day's food is harvested from one or more producing gardens. The family awaits the cooking, shares it immediately, and the livestock are also fed. Storage of peanut paste balls and giving them to the baby one by one is incongruous in a Chimbu woman's house: the pigs, or the insects, or the other children would be after any food in storage.

It seems to me that any attempt to improve infant nutrition must be part of a general program of improved living standards and community development. Genuine and permanent change requires fundamental education - people must not merely want fat babies or saucepans or motor cars but these things must be part of a changing way of life. Chimbu life has certainly changed in some particulars, but the present desires for improved standards of living, skills, peace and progress as yet are not supported by an understanding of Western life. Before mothers can be relied upon to give children peanut balls every day they must see that this is as part of general welfare. And increased protein is not enough to solve Chimbu health problems - they will still suffer from diseases unrelated to malnutrition; the peanut-feeding mother will lose her baby from pneumonia, and this will not give mothers confidence in peanuts or in the health program as a whole.

My conclusion must by now be obvious enough - a

primitive group may change a great deal in a generation. Their activities can be forcibly changed, and in some circumstances their interests may readily adapt to progressive activities. But patterns of work and organization persist. An integrated program of community development may have a great effect on adults as well as children. The proper education of youth will have an effect upon the whole community in the next generation. But piecemeal development is confusing to the people, and any specific introduction needs to be viewed in relation to cultural practices as a whole.



Plate 3. A group talking outside a men's house.



Plate 4. A group of women cook for a feast.

Discussion (following Dr. Brown's paper)

Unknown: In the New Guinea Highlands some women use cotton clothes which are often filthy. Would it not be better for them to use grass skirts until such time as they can make better use of European clothes?

Brown: I think the grass skirts are as filthy as the cotton dresses. Perhaps the grass skirts leave more space to cover the body with pig fat.

Unknown: What do you consider to be the main incentives for these people to take up Western ideas?

Brown: Do you infer that they need to be encouraged to do so, because they do not. They are very keen on acquiring European goods and are willing to work moderately hard to obtain them. On the whole they have accepted the notion of peace, progress, and development.

Dick: The question of money in the Chimbu seems to be an enigma. These people are avid for money, but this does not explain the casual way in which they disperse it. Two years' wages from work on the coast is often lost in one night's gambling.

Brown: There is a great difference between our appreciation of money value and that of the Chimbu. They do not have the money measuring notion. They do not have the "time equals money equals purchase price of goods" sort of equation in mind, that we have. They certainly get wildly enthusiastic about gambling. I have seen a boy lose his month's wages in half a minute and yet go happily away.

Unknown: The Chimbu people do not understand the Western economy. I wonder if they will be less happy when they do. The economic outlets for them are working on a plantation for a wage of £1. 10. 0 a month, or growing coffee, when if one works very hard, and has to look after subsistence as well, the best one can do is to become very poor. When they understand the Western economy better, I wonder whether they will be more prepared or less prepared to enter it.

Brown: They have been bitterly disappointed by the results from the coffee work to date. However this does not seem to have discouraged them from planting coffee, or harvesting it, just the reverse. There is a great increase in planting coffee because, they say, it is the only cash crop we have.

Chairman: A situation not unknown to dairy farmers in Australia.

Unknown: Is there any instruction given to New Guinean women about methods of bringing up their children?

Brown: There is an Infant Welfare Service to some places. A sister comes around once a month, puts the babies on a scale, gives injections where necessary, and she may treat the scabies, but she does not give any instruction.

Unknown: Are there local 'medicine men' to whom mothers turn in time of sickness?

Brown: There are no competitive practitioners such as there are in some other societies.

Unknown: Some of the cases of malnutrition in New Guinea are associated with the absence of the husband and possibly with an overworked mother. What Government measures are taken to combat this?

Brown: In the recruiting for coastal work, the Government tries to restrict the recruits to unmarried young men. It does not always succeed because some men are so keen that they go under false names. Casual labour within the Highlands cannot be controlled in this way. I have not noticed much serious difficulty because the husbands are away, because some other male in the family usually helps out.

Unknown: Have you seen any cargo cults in the Chimbu?

Brown: No, nothing that would be properly called a cargo cult.

Unknown: Is primary education voluntary or compulsory.

Brown: It is voluntary in the sense that the teacher will open the school for the new year and the parents who get there with their child first get their children into school. No one else goes to school.

But where do we go from here?

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Improvement of infant nutrition is part, but only a part, of the wider issue of social and economic development. An "integrated approach to nutrition and society" demands the integration of the problem of nutrition into the wider question of the general betterment of Chimbu life and indeed, as Paula Brown has noted, it is hard to see how attack on one facet only of the problem can be successful. As a geographer I shall discuss the betterment of Chimbu life in relation to the available productive resources, and of the means to hand for the conversion of these resources into goods and money. I shall first briefly describe the Chimbu agricultural economy, and the changes to which it has been subjected over the five years during which I have been observing the Chimbu, then I shall analyse some of the problems of that economy, and finally offer a few tentative suggestions.

The Chimbu economy

Chimbu are agriculturalists, who depend on the produce of their gardens, pastures and groves for subsistence. Only a very small proportion of their consumption is derived from wild resources: even their houses are built mainly of the wood of planted casuarina trees. Sweet potatoes are the dominant crop, and the basis of every meal, but a wide range of subsidiary crops is grown. Among these sugar cane and bananas occupy significant acreages, while taro, yams, a few cassava, a range of beans and green vegetables, and some introduced food crops are also grown. Chimbu distinguish two main types of cropped area - the open plots mainly under sweet potatoes, and the mixed plots under a wide variety of inter-planted crops. The produce of the latter is used wholly for human consumption, but a significant proportion of the sweet potatoes is fed to pigs. A grown pig consumes at least as much food a day as a grown man; at a guess some two-thirds of a pig's food is cultivated sweet potatoes, and the remaining third comes from grazing and rooting for worms in the unenclosed pastures. When preparing for the great periodic pig ceremonies, Chimbu have at least

three or four grown pigs per family, and thus at the peak, half the produce of the sweet potato gardens is fed to pigs. There are also planted tree crops, principally the nut pandanus and the oil pandanus. The former, growing only above about 6,000 feet, is planted in extensive groves, the latter grows at lower altitudes and in smaller clumps. Other indigenous tree crops occur as individuals.

This varied agriculture, with its tillage of the soil, elaborate field-drainage, and extensive systems of fencing to separate the gardens from the pigs, was conducted by individuals cultivating their own plots of land within the territories of social groups which combined for defence of the whole. The Chimbu concept of land tenure is that all arable land is the property of the man who first cultivated it, his heirs and assigns. There is no group tenure of any such land. Individual plots are scattered, and a man may have from three or four to as many as fifteen separate parcels of land.

A plot being brought into cultivation is cleared, fenced, ditched and tilled, and then planted, generally by vegetative propagation. From first clearing to planting may occupy several months, and sweet potatoes then take a further three to eight months from planting to maturity, depending on soil and altitude. Harvesting is progressive: only the mature tubers are lifted, and the immature tubers are left in the ground, so that each plant is normally harvested several times before being uprooted. At lower altitudes the harvesting period may occupy from six to twelve months, but from 7,000 feet up to the absolute limit close to 9,000 feet the period is only three or four months. The land is then commonly re-prepared and re-planted, either immediately or after a short rest. It is not unusual for five, six or even more consecutive plantings to be made on the same land, including one or more plantings of the mixed-garden crops at no fixed stage in the cycle. Ultimately, after from one or two to ten or more years under cultivation, the land will be rested, under planted casuarina trees wherever the land is suitable for them. These casuarinas emphasise the holder's claim to the land, provide wood, and build up the fertility of the soil - they add humus and nitrogen, and keep down undesirable grasses. After a fallow period of from two or three to as many as twenty-five or more years, the land is again cleared and re-planted. Thus some land is cultivated far longer than



Plate 5. Men digging ditches and spreading subsoil to prepare garden beds.



Plate 6. Peanuts as part of ceremonial distribution.

it is fallowed, other land is cultivated only rarely. Factors involved include the quality of the land, the rate of weed growth, the amount of land available to the cultivator, the shifting interests of individuals and groups, and variations in individual enterprise and vigour. In modern times a concentration of residence toward the main road in central Chimbu has led to much less frequent cultivation on some remoter land, notwithstanding its inherent quality. In general, current cultivation under food crops seems to vary between 0.2 and 0.3 acres per head of the whole population with a tendency to increase due to sales of foodstuffs and larger food intake: Chimbu informants are unanimous that the diet is both more abundant and more varied than in former times.

There have been many modifications to the traditional pattern in recent years. The range of crops has increased. New sweet potato varieties have been introduced, and one higher-yielding variety introduced about 15 years ago now covers perhaps a third of the acreage. Even since 1962 two new varieties have entered: these are probably sweet varieties of American origin disseminated from a plantation near Goroka. In all more than 40 varieties are encountered, though two of these dominate overwhelmingly in almost all locations. *Xanthosoma taro* and new varieties of *Colocasia* have also entered the area since 1933, together with new varieties of corn, yam, beans and a range of new crops including several European vegetables, new tree crops - especially the pawpaw - and one important new garden crop, the peanut. Peanuts are grown both for cash and food, and have also acquired ceremonial significance in nut presentations. The highly prized nuts of the mountain pandanus, rich in oil, fruit irregularly, and seasons of flush are marked by large-scale presentations between neighbouring groups - in a sense perhaps, a device to distribute a surplus. Not all Chimbu have pandanus trees, or land suitable for their cultivation, and peanuts have come to be accepted as a substitute in these ceremonial inter-group presentations. Peanuts have, however, a slight agronomic disadvantage as compared with other introduced crops: they must be planted to a rain, otherwise a proportion of the seed peanuts will rot in the ground. The Chimbu climate is weakly seasonal, but with a very irregular and unpredictable occurrence of drought; it is not therefore possible to be certain of the right time for planting.

All these introductions have, however, been eclipsed by coffee, which was first introduced in 1955. The acreage in our survey area at Mintima has increased at an almost constant rate since 1958, and a population of 10, 000 in the Waiye Council Area now has over 400, 000 trees. Since about 1959 coffee has been by far the principal source of cash income to the central Chimbu, and though much is badly planted, still more badly maintained, and almost all badly prepared for sale, coffee has become a major user of land. Much land that was formerly the main food crop area for the people near Mintima is now devoted to coffee, with the result that since 1961 increasing areas of long-neglected and largely inferior land have been brought into cultivation for food crops. During this period, indeed, the introduction and adoption of coffee has begun a series of revolutionary changes in Chimbu agriculture and economy, the nature of which is only now becoming apparent.

The consequences of the introduction of coffee

Chimbu agriculture, like the whole of Chimbu society, is undergoing rapid but uneven change. The pattern of land use, the system of evaluating land, the allocation of time to different kinds of work - these have changed, but the basic diet is not greatly modified, and there have been no major changes in agricultural methods. Money resources are still slender, and the coffee income is only between £6 and £7 per annum per grower. Despite the ready acceptance of cash cropping there is severe disappointment at the results. Furthermore, coffee has become a major crop only to that proportion of the Chimbu with good land between 5, 000 and 6, 500 feet, and with access to the main road. For some 25, 000 or 30, 000 people whose land is almost all at higher altitudes, and for some 50, 000 who live in remoter areas in the south of the subdistrict away from the roads, there is still no reliable source of cash income. Cabbages and onions were introduced as cash crops on the high-altitude land some three to four years ago, but the market is very limited. Only in 1963 has a long-heralded programme of pyrethrum planting been initiated, with hopes of a stable market.

Coffee has presented the central Chimbu with many problems as well as benefits, and its spread has made evident some basic weaknesses in the agrarian system. Excessive dispersal of holdings involves individuals in much walking time, and

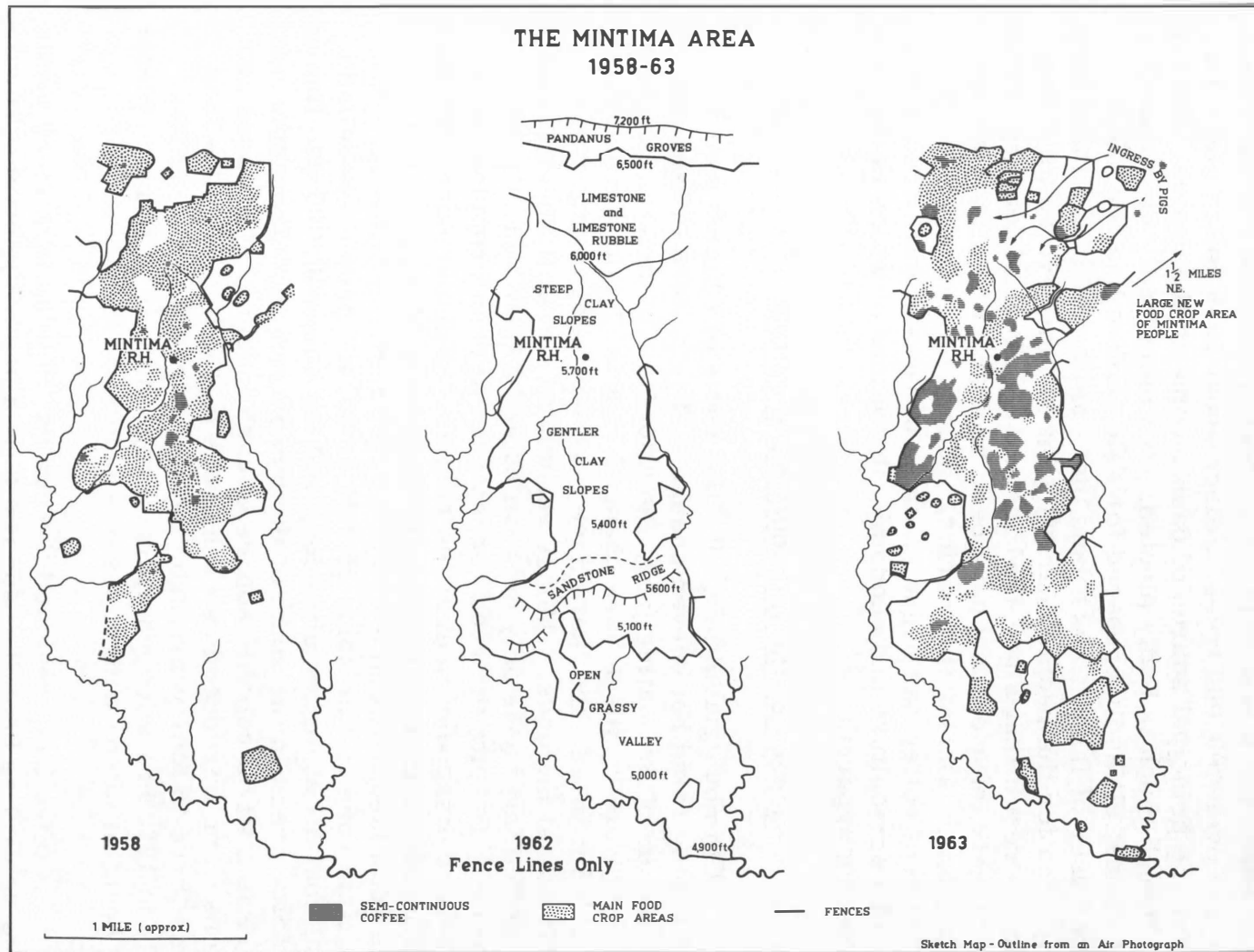


Figure 3. The Mintima area.

discourages the maintenance of fences and the weeding of grass and weeds in the gardens, with the result that much productive land is abandoned before it needs to be. It now seems clear that there is no continuous decline in sweet potato yields with successive plantings on the same land. Evidence, including that of a soil-exhaustion trial at the Aiyura Experimental Station, near Kainantu, suggests that yields are well-maintained after several years on continuously cultivated land. In central Chimbu it is however mainly the drier, easily-cleared land that is maintained in food-crop cultivation for long periods; wetter sites are soon abandoned to the quick-growing weeds. However, many of these wetter sites give high yields of coffee, and have become preferred locations. As a result of this preference, and of the scatter of plots, the labour of keeping widely dispersed and small coffee groves clean of weeds is taxing the available time and energy of many Chimbu farmers.

Fences against pigs are also perishable, and become weak and are easily broken after about three years. Under pre-coffee conditions, it seems that it was often the life of the fences that limited the period of cropping in the cycle. Once coffee is planted, however, the fences must be continuously maintained, and since coffee is generally planted on land that has already borne food-crops, the result has been to require maintenance of many fences that would formerly have been abandoned. Taking into account the high proportion of a Chimbu's time spent in just waiting around, and the unfamiliarity of any sort of routine, it will be clear why many Chimbu are confused by the work demands of their new crop.

In the early years of coffee there was rationalization of the fencing system (Map 2). Lengthy sinuosities were straightened out, isolated areas incorporated into the main enclosed block, and moves made to tidy up the whole pattern. However, the absorption of food-crop land by coffee, together with a steady increase in the demand for sweet potatoes by a growing herd of pigs, has necessitated the enclosure of large new areas for food crops, and between 1958 and 1962 the enclosed area extended southwards by nearly a mile. Dispersal of food-crop activities, and concentration of residence into the coffee areas so that men could watch their coffee, led to some neglect of the old fences, and in 1963 the inevitable occurred. Large areas of land were invaded by pigs and much garden land was rooted over. It has not yet been

possible to secure the co-operation necessary to rebuild the fences on the old lines, and the simultaneous increase in the number of pigs and in the work of caring for them has led to a return to old patterns, with long avenues leading deeply into the enclosed area so that pigs and gardens and people could be brought closer together. The result is disintegration of the relatively rational system of 1962 into a chaos of individual and small-group fences, with many internal fences within the enclosed area to protect individual gardens. All this represents a great increase in the amount of labour necessary, and creates a situation which can well lead to yet worse chaos in two to three years' time. There is therefore some evidence to suggest that, due largely to the intrusion of coffee and other new activities without any corresponding change in other aspects of the agrarian structure, the Chimbu farming economy is entering a period of, at best, confusion.

The cycle of hope and frustration

The course of events in central Chimbu since 1958 is best characterised as a cycle of hope and frustration. At the beginning there was great enthusiasm. Impossible hopes were entertained as a result of the introduction of coffee. There were other big projects, including the reclamation of a large area of waste land for the growing of other cash crops, fruit and tobacco; a dairy herd was proposed, specifically to supply milk for children, and men talked in expansive terms of turning all sorts of resources into money. Ideas arose spontaneously, and men and women undertook unaccustomed and large scale tasks with enthusiasm. There can have been few periods in the history of any part of New Guinea when there was greater popular fervour for economic progress.

As early as 1959, however, there was some disappointment in the small financial returns obtained from coffee, and depression deepened as the coffee price continued to sag in 1960 and 1961. There was no diminution in the rate of planting, for the Chimbu could see no other means of gaining wealth but coffee, but enthusiasm declined. The grandiose proposals of 1959 either failed or faded away. The large cash crop garden has settled down to sweet potatoes. A nearby medical aid post, built by the Council in what was expected to become a centre of activity and settlement, is still surrounded by only sparse popu-

lation. The dairy herd proposal ran into difficulties and was forgotten. By 1962 and 1963 central Chimbu regarded their dependence on coffee with alarm, and reports that the Government was discouraging new planting because of the marketing situation reached the Chimbu as fears that the Government might one day destroy their coffee and leave them with nothing. For the Chimbu outside the coffee areas hope of better times became a matter of clutching at straws. Recently a tortuous mountain road has been built into the hills in northern Chimbu. The people along it, who have hitherto had no hope of cash income, now expect to make large sales of onions, cabbages and other vegetables to buyers who will come up the road; present traffic is however limited to one or two Government Land Rovers a week.

Hopes run so high that disappointment is inevitable. Chimbu dream of a time when they will all have iron-roofed houses and many will have Land Rovers, when good clothes will be within their means, and they will live as Europeans now live. But though a few men with large coffee holdings have amassed considerable sums of money, the majority receive only paltry incomes of between £5 and £10 a year, and this is rapidly dissipated on Council tax, a few poor purchases, gambling, and the inflated demands of the internal economy. Thus the purchase of a bride for one of their members means that a group of 20 to 40 men must assemble sums of at least £100. These and similar calls mean that slender cash reserves must be carefully husbanded. For the majority of Chimbu the betterment of life due to the injection of money is yet small, but none the less they see money as the only road by which better times can come to them. Add to this state of mind the confusion resulting from the grafting of coffee onto their traditional agriculture, and it needs little imagination to realise that receptiveness to innovations, the benefits of which are not altogether clear to them, is at a low ebb.

The contribution of the Administration

It is, unfortunately, necessary to suggest that so great a disappointment as the Chimbu have suffered since 1958 need not have been their lot. Many Chimbu are aware of the paucity of European staff in their area, of the limited size of the local market, of the execrable nature of their roads, and of distressing

inconsistencies and frequent changes of direction in the advice and exhortation they receive from the several departments of Government. They are aware of these things, and discouraged by them, and some few are made seriously resentful. But they are not yet aware that, on a population basis, Chimbu is in receipt of an extremely low level of services even by Territory standards. The Chimbu subdistrict is the most populous in the Territory, with more people than the whole districts of New Britain and New Ireland put together; it has a higher density of rural population than any other area of equal or greater size in the whole of Melanesia. But only in 1963 was the Subdistrict raised to District Officer status. The 160,000 inhabitants have only a single qualified doctor, far below the Territory average. When the establishment is filled, there are five agricultural officers in the subdistrict today, but there was for long only one. The road grant is extremely small, and for a variety of reasons the Chimbu section of the main highlands road is the worst of any in the whole 420 miles from Lae to Wabag. There is no airstrip capable of taking a DC-3; even though the Kerowagi strip could readily be raised to this standard, development has been concentrated instead at the original centre at Kundiawa: this strip, which in topography is the nearest approach to an aircraft carrier on dry land, is hemmed round by hills and can never take an aircraft of any size. Consequently, Chimbu is heavily penalized in terms of freight rates and services by comparison with areas to east and west. The only significant capital investment from without, apart from buildings on the government station, has been the establishment in 1962 of a coffee factory at the Chimbu river, by private European interests. It is now proposed that this factory be acquired by a Chimbu co-operative, entirely by local funds and without any external aid or loan. Because of staff shortages it was not possible for the Department of Agriculture to provide any significant field guidance to Chimbu coffee growers between the initial plantings in 1955 and about 1961 or 1962, and only now is any attempt being made to centralize and standardize the preparation of coffee beans for sale - but again the funds for the necessary buildings and staff must come from local sources. It is not nice to say these things, but one cannot discuss the present mood of frustration in Chimbu without reference to the very limited amount of external aid received.

Overpopulation?

All this is the more surprising when it is remembered that since at least 1956 the view has been current that the Chimbu area is suffering from overpopulation, and furthermore that for several years Chimbu was thought to be the only area in the Territory with this problem. But not until 1962 was an official survey undertaken to determine the nature and scale of overpopulation. Meanwhile Paula Brown and I have attempted to obtain a quantitative impression of the man-land balance in one limited area for academic purposes having nothing to do with public policy, and have tentatively extrapolated our method over a wider area of Chimbu.¹ We found that some small groups, even within areas of only average density, are short of land, but that it is possible for individuals and groups to obtain sufficient land from others who are better off, by various traditional means. Though the situation is tighter in other parts of Chimbu, especially the high-altitude areas, there has been short-distance emigration from these areas for generations. So far as food-crop land is concerned, we do not think it is yet impossible for any Chimbu to obtain access to sufficient ground, but the demands of cash cropping, and especially for tree crops which may not normally be cultivated on borrowed land, are leading to rapid changes. There is a need to open new land for ambitious and energetic individuals in the not distant future, but we are fearful lest official pre-occupation with resettlement as a solution may lead to neglect of the possibilities for development still untouched in Chimbu itself.

Resettlement has been under desultory discussion for years, and various areas have been canvassed. Active land settlement surveys are now in progress in other parts of New Guinea, with Chimbus in mind. However, it is worth recalling that the Land Settlement Scheme in Fiji, now under way, is expected to cost a million pounds sterling a year for ten years in direct costs alone, and Fiji has a far smaller population than New Guinea, and the advantage of an existing network of communications, good topographic and cadastral maps, soil surveys, and

¹ H. C. Brookfield and Paula Brown, Struggle for land: agriculture and group territories among the Chimbu of the New Guinea highlands, Melbourne (O. U. P. and A. N. U.) 1963.

widespread literacy. Land settlement in New Guinea will probably cost at least £2,000 per settler, all costs included. So massive a scheme as would be required to alleviate population pressure would be costly indeed. To hazard a guess, I would suggest that it would be necessary to reduce the present population of 162,000 to around 100,000 in five years: then it would be possible to close certain occupied areas on very steep unstable slopes and simultaneously do something to improve living conditions for the remaining population. But this would cost not less than £30,000,000 and there would still remain 100,000 Chimbus, plus their natural increase, to claim funds for local development. The justification for land settlement schemes in the Territory - and it is a real justification - lies rather in making productive the undeveloped resources of New Guinea, with the aid of such energetic individuals, from whatever area, as wish to participate.

Possibilities of local betterment

Possibilities of betterment in Chimbu itself have certainly not been exhausted. With the exception of some trials now being undertaken by the Division of Medical Research, no extensive study has yet been made of the possibility of introducing improved - either higher-yielding or more nutritious - varieties of any of the main basic food crops, of evolving methods of storing or processing these crops, of the possible effects of fertilizers on yields, or even of the different possible crop rotations. No investigation at all has been made of the possibility of making pig husbandry more intensive. At present this aspect of Chimbu production is very wasteful of resources, both of land and labour, for very small returns. The introduction of new fodder crops would surely repay investigation, together with the fencing in of the pigs, instead of the crops, and using more durable fencing materials; pig housing and health are susceptible of great improvement, with the object of reducing the present heavy losses from mortality. While one could scarcely expect in the short run to achieve anything so efficient as the economy of the Chinese pig-farmers of Singapore Island, it should surely be possible to increase output of this high-protein source of food with much greater economy of land and labour.

A wide range of fruit and vegetables can be grown in Chimbu at different altitudes and on different soils; resolute

attempts to solve the marketing problems could greatly aid exploitation of this possibility; it does not seem impossible to develop an industry that, together with adjacent areas, could in time support a cannery. At high altitudes, and above the present tree line, are extensive stands of pandanus, producing nuts rich in oil, but there has as yet been no survey at all of these nuts as a possible economic resource. Nor for that matter does any thought seem to have been given to other possibilities for making use of this high mountain country.

Improved communications are fundamental to everything. The large resources of limestone in Chimbu are among the purest in the Territory: lime could be used for the stabilization of road surfaces to provide smooth highways capable of carrying heavy traffic; lime is also a potential industrial resource from which could flow a revolution in building and constructional materials. Improvement in roads, and the upgrading of Kerowagi airstrip, could make possible a substantial reduction in freight costs, to the great benefit of all forms of trade and development.

An immense amount could be achieved by the rationalization of scattered land holdings into coherent blocks. Such a move would both facilitate and demand the development of specialized farmers, each conducting one dominant enterprise, and Papua-New Guinea could have much to learn from the energetic work carried out especially in Kenya in the past decade. In an area of high population density, a side result of land consolidation would certainly be to create a landless minority, who would provide a population of wage-earners and potential settlers; this consideration might give pause to some, but it should be remembered that population increase and the rising land demands of cash cropping make inevitable the emergency of a land-poor class in the near future, and this without any improvement in local living standards such as might flow from farm consolidation.

Conclusion

Above all there is great need for new drive. Chimbu are impatient for progress and weary of disappointment. They can readily see the benefits that money can bring, but are growing tired of unsuccessful endeavour and of frequent exhortation by the Government and their pro-Government leaders, who constantly demand additional work on ever-changing projects. Active

resentment is growing among a significant minority, even though the majority still adhere to the faith that their labours will bring rewards in the end, and that the advice of the white man is almost always good.

It is against this background that the peanut project needs to be viewed. There can be no doubt that the Chimbu are concerned for the health and well-being of their children, but their thinking is essentially financial: they see money as the only way to improvement of their lot. It does not yet occur to them that their diet is nutritionally inadequate: their talk is rather of the low price of coffee and the high cost of trade-store goods. There has certainly been an increase in the very small number of plots planted to peanuts since 1962, perhaps a doubling in the Mintima area, but this is mainly in the hope of cash sale, especially to the hospital. When increased planting leads to saturation of this market more peanuts will be eaten, both by adults and by children, but planting may then decline. The fate of cabbages is a pointer: they were grossly planted in the hope of sale in 1962. Many unsaleable cabbages were certainly eaten, but many more were left in the ground and new planting is much reduced.

If confidence is to be restored, progress made, and valuable introductions like the peanut project given a chance of success, there is need for a comprehensive development programme, embracing health, housing, education, agriculture, land tenure and employment, with a great increase in the proportion of external aid, both technical and financial. Local resources cannot provide the necessary capital, and will not be able to do so in the foreseeable future. There is also a need to integrated planning and a determination of priorities. Something like a National Development Authority, covering not only settlement of new areas, but also, and principally, the fuller utilization of resources among existing populations, is now long overdue in New Guinea.

Pledges are frequently reiterated that Australia means to create a measure of economic viability in New Guinea before handing over political responsibility. But time is not endless, and progress in this most populous area of the Territory is so far satisfactory to no one. One hopes that the effort made in Chimbu to date is not to be taken as the worth of these pledges,

for if this be so, then it were better that the pledges had never been made at all.

Footnote: October 1965

In the nineteen months since this paper was written there have been a number of changes. The Kundiawa Coffee Society Ltd. has come into being, with native shareholders and - finally - some recourse to bank loans. The Society has proved phenomenally successful in the marketing of coffee, and better prices are being obtained. The result is a new wave of enthusiasm that has to some degree overtaken the wave of disillusionment described in the paper. But the problem remains as here described for people living outside the coffee regions, and even within them dissatisfaction with the rate of progress continues, most especially with the rate of progress in education. The cycle of hope and frustration remains a cycle, and to convert it into an upward trend will demand constant new innovations for some years in order to generate and maintain enthusiasm, as well as to diversify the economy and the interests of the people.

Discussion (following Dr. Brookfield's paper)

Unknown: Since pigs are in direct competition with crops, it may be possible to supplant pigs with sheep, although it would be a tremendous sociological problem. I know of the failure of sheep at Nondugl, but the failure there was due to factors that could be overcome.

Brookfield: A pig certainly derives a portion of its food from a cultivated area but sheep would require large grazing areas. It would be more economical to grow more fodder crops for the pig, because this would free the present pig-grazing areas for the crops. With the exception of one species the natural grasses are not suitable for sheep.

Unknown: I wonder if the sheep has not been dismissed too summarily? I am not sure that sheep require large areas of grazing, if you use sheep in small plots grazing amongst tree crops. We should think of sheep not so much for wool, but as an additional source of protein.

Brookfield: That may be true, but until the pasture grass problem is solved one cannot make any firm announcements on this subject.

Dr. Frankel: I would have thought that the pig, being omniverous, was better suited to the ecology of the region than the sheep which, being a more selective feeder, would create many more difficulties.

Unknown: What was the training and experience of the 5 agricultural officers and do they live in the area?

Brookfield: They are dispersed at various Government stations. They have either a University Agricultural degree, or a diploma from an Agricultural College.

Mr. Dick: The Administration must allocate officers throughout the Territory. In order to show the difficulties of working in the area, Gumine is about 25 miles by air from Kundiawa. The district has a population of 40,000 and yet it is two days walk from Kundiawa where the nearest agricultural

officer is stationed.

Unknown: What are the possibilities of high altitude tea?

Brookfield: Tea experiments have been carried out in New Guinea for several years, but it requires such care in cultivation that it is unsuitable for a native cash crop at present. It has taken long enough to persuade the Chimbuses that growing coffee is not simply a matter of planting a seed and picking the beans. Tea culture is under consideration but with the present meagre resources of agricultural officers let us not complicate the situation by another crop that will add to the difficulties.

Sir George Currie: I would like to ask about land tenure. There are suggestions that a better distribution of effort could be achieved by a redistribution of the land so as to bring together the small plots under one person. I think this plan bristles with legal difficulties. Just how would the speaker set about the redistribution of land which is related to better production, and a movement towards a viable economy?

Brookfield: That, Sir George, is a very large question.

Chairman: The legal problem bristles with difficulties, but so does any plan which touches land in New Guinea. Chimbu customs of land tenure are not fully understood by the Lands Commission, and I don't think by us. The basic principle seems to be that Chimbu land is individually held, but this is complicated by a series of rights held between individuals of the groups to which the owner belongs. Land belongs to the individual who first cultivated it, and transmitted to his heirs. Holdings are widely scattered within a sub-clan area and an individual may have plots scattered all over it. Distances of over 3 miles between plots are quite common. There is an enormous amount of walking time involved. One also has the problem of fluctuating groups of individuals combining to cultivate land first in one area and then in another. The inefficiency of this situation is tolerable in a subsistence economy, but in a cash crop economy it is becoming intolerable. As for how to do something about it I think note should be taken of the extensive work that has been done in East Africa since 1950, where the land situation is similar to the case of the Chimbu, and the land has been the subject of a major re-organisation, including the consolidation of holdings. The develop-

ment of specialised farms on different types of land has, of course, resulted in the inevitable creation of a proletariat, and this is not without problems. But I do not think we will get anywhere with economic development in New Guinea under the present system of land tenure. It is not well adapted to the new economic system, and completely ill-adapted to any system of improved animal husbandry. I do not advocate any particular programme, but notice should be taken of success and partial success elsewhere in land redistribution.

Unknown: Some may infer from Dr. Brookfield's remarks that the only hope for economic development in New Guinea is the infusion of a large amount of capital from outside. Is there any hope of this happening?

Brookfield: I am quite unable to answer.

Unknown: Do you think a collective-farm system such as has been instituted in Israel, would improve the economic status of the people?

Brookfield: That is a nice question. My vision of a Chimbu co-operating in a collective farm was so excruciating, I had to shut my eyes tight for a minute. Given a radical programme for education, given a man standing over a Chimbu with a whip the scheme might be a success, but without these things, no.

Unknown: With reference to the East African settlement schemes, there was a good deal of coercion used. I do not think that any re-settlement scheme in the Chimbu would work without a good deal of coercion.

Brookfield: I quite agree. I do not think coercion is avoidable. It must form a part of any departure from the present situation.

Nutrition and economic progress in the Chimbu

R. T. Shand

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Nutrition and economic progress are significantly inter-related in many underdeveloped countries. On the one hand, rising per caput incomes can permit improvements in the volume and balance of the diet, directly, through the opportunity to increase food purchases, and indirectly, through the chance to accumulate capital which can enlarge the productive capacity of the individual producer and eventually augment his income. On the other hand, better diets may have important effects upon the economy. The physical capacities of the work force may be raised, the life expectancy of the population may be lengthened and the rate of population growth increased, these last two combining to expand the size of the work force. In short, there are economic consequences of nutritional improvements and nutritional consequences of economic advances.

However, the economic effects of any successful nutritional programme may not necessarily prove beneficial, since the relationship can also work in the opposite way. The most decisive factor influencing the effects is the relation between population and non-human resources (land and capital). When population is pressing heavily upon available land, when money capital is scarce, and when the marginal productivity of labour is low, additions to the work force or an increase in the work capacity of the labour unit may realise far less than proportional increases in output. If the output expansion does not match the rise in population, for example, a fall in living standards will result and hence the correction of the nutritional problem only aggravates the economic one.

It is when labour is scarce in relation to other resources and the marginal productivity of labour is high that successful treatment of nutritional problems would benefit the group economically through the additions to, and greater efficiency of, the work force. However, serious and widespread nutritional problems are probably less common under these economic conditions.

The implementation of a programme for nutritional improvement obviously necessitates a familiarity with the existing economy. If the success of the programme is expected to have substantial economic repercussions, it may be necessary to attempt an integration with plans for economic advancement in the region. But in addition, the type of economy plays an important part in deciding how the programme will be operated. If it is a pure subsistence economy, the best method of increasing protein intake may be through some modification of traditional agricultural activities, while if it is a fully monetised economy, it will be more effective to market a protein supplement through normal retail channels.

In examining the nutritional problem of the Chimbu from an economic viewpoint, we might first review the relevant medical points in Dr. Bailey's paper:-

1. Protein malnutrition is important principally among lactating mothers and among young children between 4-6 months and two years. Overall incidence in the 0-5 year age group was about 3% in the Chimbu and in 1956, one estimate showed that it was responsible for about 27% of deaths in children under 5 years.
2. It does not seriously impair the performance of adults.
3. The problem can be quite easily overcome for children by the digestion of small amounts of a protein supplement.

The main impact of a correctional programme would be on the mortality rate in the age group between $\frac{1}{2}$ and 5 years, and the most interesting effect of this would be the change in the size of population which would follow the fall in the death rate. No exact estimate has been made but at a guess it might raise the rate of population growth about 0.25%.

The Chimbu is one area in Papua-New Guinea with a high concentration of population; in some sections there are 400 or more per square mile. In such conditions, a high rate of population growth can have serious consequences. At the moment, the rate of increase is probably around 2% so that, even with the increase which would result from a successful elimination of the protein problem, the rate at 2.25% would still not be particularly high. Substantial economic repercussions would only arise if

the nutritional scheme was made part of a broader health programme for the area, for example including malaria control.

The population-resource balance is examined more closely in the following sections but it is apparent that the nutrition scheme would not alter it significantly. Thus in this case, the relevance of economics to the nutritional problem is restricted to the influence the type of economy might have on the way in which the programme is carried out. In the two sections which follow, the present state of the economy and its future prospects will be reviewed. In the final section an appraisal of the peanut-feeding programme will be attempted in the light of these economic observations.

The Chimbu economy today

By comparison with many other subsistence groups both within and beyond Papua-New Guinea, the Chimbu people were quite favourably placed for resources in their traditional state. Despite a heavy concentration of population, they were able to provide for their own needs without reaching the limits of available land or labour. Contact with Europeans has induced, in recent years, a range of more sophisticated wants which have stimulated additional money-making activities to serve them. Coffee growing has become by far the most important of these activities, though there are other minor ones, such as vegetable production and wage employment outside the area.

As part of a broad survey of the development of indigenous cash cropping in Papua-New Guinea, the writer and Mr. W. Straatmans recently completed field investigations of cash cropping in the Sina Sina Census Division of the Chimbu Sub-district. Data were collected on the economic activities of the area both from secondary sources and from interviews with a sample of 20 families, which together throw some light on the present economy. The Sina Sina Division contained about 16,000 people in 1961, roughly 10% of the population of the whole sub-district. With a total area of 64 square miles, there were in that year an average of 246 people per square mile or in other words there were 2.67 acres per head of population, the figures varying somewhat from tribe to tribe. If an average family size of five is taken, the average total area available was 13 acres per family in 1961. Measurements taken in the survey

sample gave an average area of 10 acres per family of this size. This latter figure takes no account of idle land not included in the agricultural cycle while the estimate of 13 acres includes unusable land so the actual average figure of land available for use is probably between these two limits.

There were substantial variations between families in the areas devoted to various uses, but on average, about 2.4 acres were under cultivation for food, another 7.2 acres were in fallow as part of the food cycle, while only 0.4 acres were planted to coffee, the main cash crop. If about 9.6 acres are required for the subsistence cycle and total land available is between 10 and 13 acres per family, there are obviously severe limits to the area of land which can be spared for cash cropping and even greater limits to the area of land suitable for these enterprises.

Although there was considerable variation in size of coffee gardens between families in the survey sample (from zero to nearly 5 acres) only 2 growers registered more than 1 acre and four of the 20 in the sample had no coffee at all, indicating clearly how marginal cash cropping is in the area. These figures are substantiated by grower registration figures for 1962, which show that there were about 2400 growers in the Census Division and an estimated 274,000 trees, giving an average of a few over 100 trees per grower, or less than $\frac{1}{5}$ of an acre on spacing standards recommended by the Department of Agriculture. Moreover, poor planting and maintenance methods and incomplete harvesting reduce yields well below their potential.

Coffee growers are spread fairly evenly among the four tribes in the Sina Sina; the percentages of adult male producers in each tribe varied between 49% and 60%. There is considerably more variation within the sub-groupings of the tribes: in one tribe the percentage of growers among the adult males of the different clans ranged from as low as 27% to as high as 77%, due principally to the uneven distribution of suitable land between the clans.

Although the absence of records prevented any exact calculation of money incomes in the Sina Sina survey, the total earned by the sample of 20 informants from sales of coffee appears to have been about £230 in 1962/63, an average of £12 per family. Cash income from other sources, principally the

sale of vegetables, brought this latter figure to £13. Reported income from wage employment was negligible.¹ There was a considerable degree of variation around this average - the range was from zero to £57 - though the main concentration was between zero and £10 (11 out of 20 were between these limits), and only two received a cash income greater than £30.

Consideration of money-making enterprises in isolation gives a distorted view of the economic activities in such groups as the Chimbu since so much of their work is bound up with subsistence needs. Without some unit of value applicable to both traditional and modern sectors, it is difficult to gain a total picture. Fortunately a monetary valuation has recently been applied to all non-monetary activities in the indigenous sector for the Territory as a whole.² Total non-monetary produce per caput valued monetarily for 1962/63 amounted to £51. 10. 0, and taking an average family size as five, this would give an average non-monetary product of £258 per family. The figure is composed of the value of production for consumption³ (food, clothing and housing), non-monetary community investment (village, public and council work), and non-monetary private investment (in particular the value of new or replacement tree crops, and value of labour in Mission gardens and works). The value of production for consumption per family is by far the largest component of the total, amounting to £204.

From a combination of estimates of cash income from the survey and of non-monetary income which accrues to the family, an average figure of £216 is obtained for income per family from all sources in 1962/63. At present only 6% of family income is derived from the monetary sector.

There are three European-owned trade stores in the

¹ The sample was not designed however to afford a fair estimate of income from this source.

² Fisk, E. K., 'The subsistence sector', Chapter III in National Income Estimates for Papua-New Guinea, 1960-63. Government Printer, Canberra. February 1964.

³ The value of production actually consumed would be lower than this as the total figure includes wastage.

Sina Sina and a number of small native "bush" stores which draw their goods from the European stores. Figures for nine months trading were obtained from the largest of these trade stores. These figures do not provide any estimate of total expenditure for the area but they do give a fairly reliable picture of the expenditure pattern and the relative importance of the various categories (Figure 4). The gross value of sales (October 1962 to June 1963) was a little over £10,000, and adjusted for the full year, the figure came to nearly £14,000. Almost half of the total was composed of clothing sales, altitude probably being the major influence here. Food was second in importance and smoking filled third place. The main categories of food sold were meat, fish, biscuits, dripping, soft drink, milk, sugar and salt. Capital equipment such as gardening tools, saws, axes, coffee pulpers and grinders made up about 5% of sales.

Inventories taken of imported durable goods accumulated in the homes of those in the survey showed that most of the goods had been purchased since 1958 when coffee gardens first began to produce in some quantity. At cost price, the total value of these articles came to an average of £20 per family, varying from zero to £71.

Since there is such a heavy concentration of population in the Chimbu Sub-district there is quite a large sum of money earned within the area even though individual money incomes are still small. But it is obvious from the foregoing details on production activities and consumption patterns that the intrusion of the modern economy has barely begun.

Economic prospects

Discussion of the economic prospects of the Chimbu can be most conveniently approached by dealing in turn with the principal factors which influence progress, namely, economic attitudes, available resources, enterprise opportunities and public policy.

Answers which Sina Sina farmers gave to questions about future plans for cash cropping indicated a strong interest in economic advancement. Of the 20 farmers interviewed, only two showed no enthusiasm for making an attempt to obtain more cash income, another exhibited limited interest while the

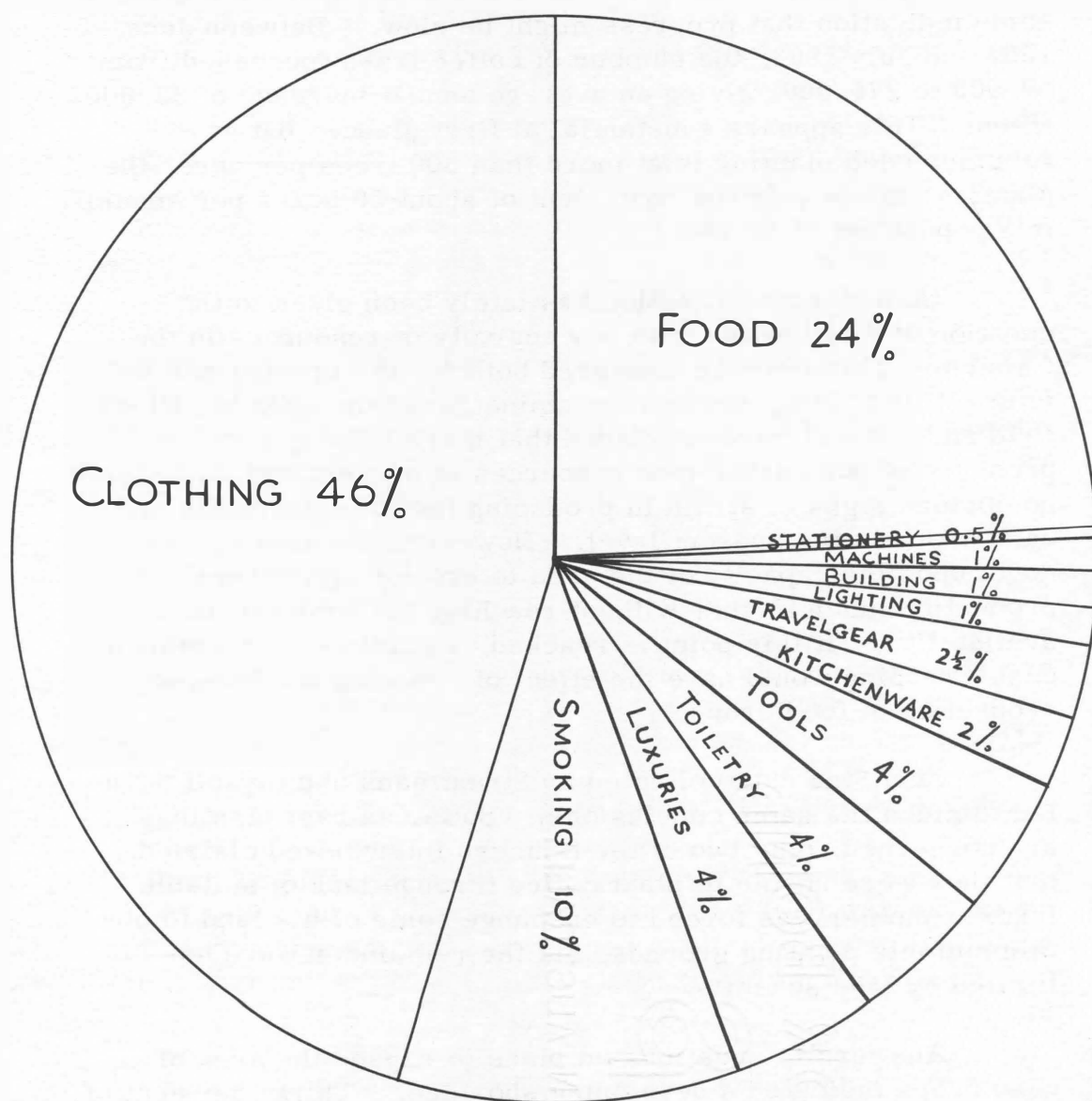


Figure 4. Pattern of sales in a Chimbu trade store.

remaining 17 expressed an active wish to expand plantings in order to earn more.

Given that most have plans for future plantings, the next most important consideration is the degree of expansion which these plans will engender. Unfortunately no indication of this could be gained from the interviews but past experience gives some indication that progress might be slow. Between June 1955 and July 1963, the number of coffee trees increased from 50,000 to 274,000, giving an average annual increase of 32,000 trees. This appears substantial at first glance, but as recommended planting is at more than 600 trees per acre, the planting rate is only the equivalent of about 50 acres per annum in a population of 16,000.

Considerable attention has lately been given to the question of whether there is any scarcity of resources in the Chimbu. This must be answered both for the present and the future. In a comprehensive examination of the Chimbu, Brookfield and Brown⁴ have concluded that there is no general pressure of population upon resources at present and there are no obvious signs of strain in producing food requirements and cash crops to the present level. However, the authors cast doubt upon the capacity of the area to expand agricultural production much further without reaching the limits of land availability. If this point is reached, a continued expansion of cash cropping would have the effect of reducing the level of production of food crops.

Sina Sina data collected by Straatmans and myself have led to much the same conclusions. So far as past plantings are concerned, only two of the farmers interviewed claimed that they were unable to plant coffee through lack of suitable land. Another was forced to exchange some of his land to obtain suitable planting grounds, but the remainder were not limited by land scarcity.

Answers to questions on plans to expand the area of cash crops indicated a developing shortage. Thirty per cent of

⁴ Brookfield, H. C. and Brown, P., Struggle for Land. Oxford University Press, 1962.

those interviewed claimed that their plans were limited by a lack of suitable land, i. e. twice the number that had been affected in the past. Admittedly land ownership is not evenly distributed between families, but it is unlikely that a more even distribution would materially alter the situation, since there are no outstandingly large landholders among the groups. It is safe to conclude that while land used for subsistence is held intact (both in cultivation and in fallow) the limits of available land suitable for cash cropping will be quickly reached by most farmers and cash incomes will still be at a low level.

If this situation were to continue unaltered, the economic prospects for the region would indeed be poor. Family incomes, inclusive of subsistence, would seldom exceed £300-400. However, there are possible changes. One is an advance in the techniques of food crop production. At the moment, the system of semi-shifting cultivation practised by the Chimbu produces high per acre yields of the main crop, sweet potatoes. But after four years in production land must be spelled for 10 to 12 years, so an acre of land is in use for only one in 3 to 4 years. If innovations were introduced which could permit continuous cultivation of food crops, more land would be released for the production of cash crops. Alternatively, it may become possible to reduce the length of the fallow by introducing, for instance, leguminous cash crops, without thereby reducing the long term yields of food crops. As yet very little experimental work has been carried out on the subsistence cycle.

It has been assumed that cash crops would continue to be supplementary to subsistence activities and so we have tacitly accepted a policy of continuing self-sufficiency for the individual. This may not prove to be economically wise in the future. As markets for food products grow throughout the Territory, it will become possible for increasing numbers of farmers to purchase their food needs. If they find that the returns from an alternative money-making enterprise more than cover the cost of purchasing food, they may break from the tradition of self-sufficiency, specialise in cash crops, and thereby increase their cash and net incomes.

With the use of Fisk's figures for the money value of food produced in Papua-New Guinea and with population data for the Territory, a rough average figure of £180 per annum is obtained

from calculations of the value of food produced and consumed by a family.⁵ Sina Sina data show that about 2.4 acres are under cultivation to produce this food while another 7.2 acres are left in fallow. Thus 9.6 acres are needed for the annual production of this £180 worth of food. This gives an annual gross income of approximately £19 per acre from subsistence production. If the gross return from a cash crop is substantially higher than this (and labour requirements are roughly comparable) a swing from self-sufficiency towards specialisation may be economically justified.

For example, the potential yield of unfertilised coffee in the Sina Sina is around $1\frac{1}{2}$ lbs per tree or 1,000 lbs per acre. At an average price of 1/- per lb there would be a gross return of £50 per acre.⁶ If food was available, it would obviously be profitable to buy it and grow coffee instead since there would be a net gain of £31 per acre. However in practice, there is not this sizeable difference. Actual harvested yields of coffee probably amount to only $\frac{1}{3}$ lb per tree due to poor planting, maintenance and harvesting techniques.⁷ This reduces per acre income to about £20. If these approximations are near the mark there would be little gain in switching land from food to coffee production, though better supervision and technical assistance could raise yields closer to their potential and could justify specialisation. If such specialisation were to prove profitable, the release of the 10 acres used for food production would raise the development horizon considerably.

It is thus possible to argue that the developing land shortage may not prove critical for the long run development of the Chimbu, if one of the above possibilities eventuates. But one of the most critical problems is to single out enterprises

⁵ This estimate is on the high side since Fisk states his production-for-consumption figures overstate the quantity actually consumed (cf. p.71 footnote 2).

⁶ If a high quality bean could be consistently produced, the average price received could be as high as 1/6d per lb. and acre returns could be as high as £75.

⁷ Rough estimates supplied by Mr. G. Dick, Department of Agriculture, Papua-New Guinea.

which will afford a satisfactory and dependable rate of return for these farmers. Coffee has been the main hope since the 50's but the world market has reached such a state of oversupply that producers have been forced to accept an agreement which incorporates a system of export quotas in order to bring some order to the chaotic state of the market. Although Papua-New Guinea has received favourable short-term treatment within the Agreement, there appears to be little chance for future expansion of coffee exports which would enable the industry to play an important role in the long term development of the Territory. This is a serious setback for the Territory as a whole but particularly for the Chimbu. The effect of restrictions will be to reduce the momentum of progress in the area.

There is considerable variation in the physical environment within the Chimbu, so that all parts will by no means have the same potential for development. Economic opportunity has been scarce at high altitudes, especially above the coffee line at 6,500 feet; much of this country is too steep and rugged for any enterprise. On more cultivable slopes at high altitudes there are now hopes held for the cultivation of pyrethrum. If yields of 800 lbs could be obtained, it might be possible for growers to gross as much as £60 per acre. As yet, however, the industry is barely past the experimental stage in the field, and the extent of the market has not been determined.

Peanuts have been grown for some years, partly for sale and partly for consumption. A good crop yielding 12 cwt per acre would give a gross return of about £30 at a price of 6d per lb, or up to £60 per acre if double-cropped. Future expansion of this product in the Chimbu may require a more assured market, particularly in Australia, together with more stable prices. Fluctuations have reduced prices to very low levels at times in the past and these have discouraged many growers. Tobacco has also been grown on a small scale in the villages and quantities have been bought at low prices for the production of twist tobacco. Prospects would be brighter for this crop if there were a market for better grades, e. g. if Territory tobacco were incorporated in the production of cigarettes. Small quantities of vegetables have been sold locally and in Goroka and there have been hopes that European vegetables could justify development, but distances to markets of any size and the difficulties of access to the producing areas have made transport

costs high enough to preclude large scale expansion in truck crops.

With such a limited land area available to each farmer, it would seem most logical to endeavour to concentrate on crops which can give a high return per acre with intensive cultivation. Unfortunately, now that restrictions are to be placed on coffee expansion with the possible but untested possibility of pyrethrum there seem to be no such products on the horizon. For want of one, the best prospects may lie with the development of animal industries. A beef cattle industry seems to be the most feasible possibility; it could probably be blended with the production of food crops through the use of fallow land for grazing. Pasture swards may have a low carrying capacity at present but it may be possible to raise this later with improved species. Individual native-owned herds are now being encouraged, either as breeding or fattening projects. Government livestock Stations sell the cattle to the natives and they supply fencing and other facilities, the costs of which are later recouped from proceeds of project sales. The growth in number of projects will be largely governed by the rate of turn-off possible from the Government Stations.

There would also seem to be good long term possibilities for the foundation of a dairy industry around Goroka where milk concentrates could be manufactured, and later possibly fresh milk could be produced. If this should develop satisfactorily then improved transport facilities between Goroka and the Chimbu might open up part of this latter area as a source of dairy products. There will be substantial problems of training in animal husbandry and sanitation to contend with in the early years, but with adequate advice and supervision from the Administration, these problems should not prove unsurmountable. Apart from cattle, potentialities may also lie in the development of the poultry and pig industries, particularly the latter since it is already integrated with subsistence activities.

There are then some enterprises which show degrees of promise but all individuals within the Chimbu do not have the same opportunities to take advantage of them. Some limitations of opportunity affect groups as a whole, e. g. those who live in the more remote parts of the Sub-district are especially restricted by difficulty of access, by altitude and by a low propor-

tion of useful land available. Other limitations affect only certain members of a group. The unequal distribution of resources between members of a clan is the most common example. Both are problems developing out of a new desire for advancement since in precontact times each member generally had sufficient resources to meet his limited needs. For individuals who are striving towards new living standards these differences in resource wealth take on a new significance. Special measures, such as resettlement, may have to be introduced for those who are now found to be particularly badly placed for development.

There are programmes of resettlement being considered for the Chimbu whereby numbers would be moved to other parts of Papua-New Guinea with potential for development, but which are under-populated at present. Parts of the North Coast of New Britain would be able to absorb considerable numbers transferred in this way. Such an idea is encouraged by the brighter market outlook for agricultural export crops, such as cocoa and copra, produced at lower altitudes. Against this, there would be heavy expense involved in transporting settlers to the area and in providing minimum facilities in such an undeveloped location. However, if it were possible to limit total costs per settler to a reasonable figure large scale resettlement programme could measurably relieve the short run Chimbu resource problem. For example, if a settler and his family of four could be established for a cost in the vicinity of £2000, then £2 million per year could shift 4,000 people to the new area and a 10-year programme could reduce the population of the Chimbu by nearly one-quarter. This may be an optimistic set of cost figures but they do suggest that relief by resettlement is not impractical.

It is debatable whether expensive programmes of resettlement represent the best way of encouraging long term agricultural expansion, or whether transfer to isolated areas offers the best result from resettlement, given the limited amounts of public capital available for investment. But it might well be argued that the Chimbu case deserves special treatment on the grounds that there are numbers who suffer under the hardship of having virtually no economic prospects. If population pressure increases further through a rise in the rate of population growth, there may be a risk of declining living standards which would intensify the problem.

There is an urgent need to discover a cash-earning product which can be expanded now that coffee is to be restricted. Without one, the outlook for fast economic development in the near future is not bright. There will be some increase in output of coffee as more trees come into bearing and productivity is raised, and further plantings will be made on a small scale but money income will not be rapidly augmented from any other source and new enterprises will take some years to play a significant role.

The rate of progress will be strongly influenced by the intensity of direct persuasion and encouragement, technical assistance and supervision provided by Department of Agriculture officers. The lack of finance and personnel has severely limited extension work in the past - many farmers see an Extension Officer only once a year - and this slowed the rate of progress. Yet it was evident in the Sina Sina that past coffee plantings were still principally governed by the amount of extension work carried out by Agricultural and Native Affairs Officers. A combination of intensified technical assistance and improvements in the road network could encourage a faster rate of economic progress in the future.

Conclusions

There are three basic methods of organizing a protein feeding scheme. A supplement can be distributed free of charge by some central agency, it can be produced by the consumers themselves (a grow-it-yourself programme), or it can be sold through normal trade channels. In an agricultural economy of a purely subsistence character, there are of course no commercial trade channels to use and the most practical method is to persuade farmers to produce for their own needs. At the other extreme, in fully monetised economies, consumers would usually be educated to purchase the appropriate supplement. The economy of the Chimbu contains both subsistence and monetary elements but it is still primarily subsistence in character. There are numbers who earn no money at all and the great majority of those who do, earn very small sums.

The fact that the Chimbu is a mixed economy makes it more difficult to devise an effective nutritional programme. On one hand a scheme for distributing a protein supplement through trade channels would neglect those who have either insufficient

money to be able to purchase it. On the other hand, a scheme which attempts to influence the community to grow their own needs fails to take account of the new economic trends. As a matter of principle, if a cheap supplement can be made available through the market, it may be more profitable for farmers to buy it and to earn more than its cost by devoting those resources to a cash enterprise, unless of course the production of the supplement is in fact the most profitable use of the resources.

In view of the fact that it must be allocated regularly throughout a rather rugged and mountainous region to small and widely scattered groups, a system of free distribution would appear impractical and expensive in terms of money and manpower. The best approach in the Chimbu may well be to combine the other two schemes: promote a grow-it-yourself scheme among the more economically backward but also develop a cheap and palatable product which could be advertised and made available through the trade stores for the more economically advanced. Incidentally, the consideration of a marketed product might lead to the choice of a product other than the peanut as the base for the supplement, e. g. skim milk powder, fish paste or some other plant protein. Given equal palatability, the choice would be made on the relative cheapness of the alternatives. The relative emphasis placed on the growing and buying parts of the programme would vary with the evolving economic status of the people in the region. So long as money incomes were low or absent the grow-it-yourself programme may have to be emphasised, while economic progress would encourage the gradual substitution of marketed products for the home-grown product.

Discussion (following Dr. Shand's paper)

Unknown: Would Dr. Shand tell us about the language problems in the interviews in his study? From my experience I feel hesitant about the validity of the replies to questions.

Shand: Language is a difficulty and I am not confident that we have totally overcome the problem. The method used by Mr. Straatmans, who is working with me, depends on a considerable personal rapport. The value of the interviews is greatly enhanced because he is a very skilled interviewer. The study design was one which could be applied in a more sophisticated community, but with translation of questions by Mr. Straatmans into the appropriate form for these villages I am confident that the replies were quite reliable.

Crocombe: Professor Marwick yesterday gave us an example of the dangers of the question and answer technique. He showed how when he checked verbal answers with actual behaviour he got very close to the opposite result. I do not suggest that in Dr. Shand's survey this would necessarily be so, but all of us working in New Guinea must base our conclusions on measurements and not on statements.

Shand: I would like to agree, but in situations where measurements cannot be taken, one can still utilize statements of intentions. Where measurements were possible and statistics available, they were used. Questioning was used as a cross-check on statistics collected and to ascertain future plans and the factors which influence them. The comparison of the replies with actual plans carried out may well conflict in some cases but I know of no other way of collecting data ex ante. I would be most careful to avoid any assumption that intended plans are necessarily those carried out.

Unknown: Is there a possibility of a fishing industry to bring in more protein foods?

Shand: There are plans for developing a fishing industry in the coastal areas of New Guinea, but not on the inland river systems so far as I am aware.

Chairman: There are experimental fish ponds at Mt. Hagen, but what the potentialities for these are, I do not know.

Shand: If the coastal fishing industry prospers, it is possible that fish paste or powder could become a marketable product within New Guinea.

Mr. Dick: Experiments have been conducted in the highlands but relative to the size of the population, the extent of the likely fish protein would not be very significant.

Unknown: Many of the technical staff in New Guinea are inexperienced in local conditions. They are trained in more technologically developed countries.

Shand: It takes time for a new officer to become accustomed to the area in which he is working. If staff are moved too frequently some of the value of experience in local conditions may be lost.

Unknown: If milk powder was flavoured to taste like roast pork, for example, would it be more likely to win favour in New Guinea?

Bailey: Several alternative legumes have been tried in various parts of the Territory including the green gram, and chick pea (cajanus cajan). Soya beans have successfully been introduced into some areas, for example the Baiyer River Area of the Western Highlands, where the people considered Soya beans tasted like peanuts and called Soya powder made from Soya beans, "peanut powder". With regard to milk the outstanding problem is that it is (and probably always will have to be) imported.

Unknown: What were the earnings in the best group in Dr. Shand's sample, and how did he account for the best conditions?

Shand: The leading grower in the sample, who was earning about £50 per year, has a considerable amount of land available, and also had the greatest amount of previous contact with Europeans. He worked in plantations for a number of years; he was something of a commercial leader. He com-

bined entrepreneurial talents with available resources.

Unknown: Would Dr. Shand give us his views on the possibility of establishing local industries in the Chimbu area. Some provision must be made for the future surplus population who can't live on the land. In the Chimbu area there are considerable resources of limestone and if gypsum could be imported and use made of the fast flowing Chimbu river for hydro-electric power without any elaborate dam, it should be possible to manufacture cement in the area. Once you have cement it would be possible to put a better surface on the roads and thus improve communications. Once you have an industrial enterprise with people employed in it and earning money, you can turn the economy into something more than a cash economy and attract further industry.

Shand: It is hard to give a judgement on this sort of project without having available information about the market, transportation costs, etc., but it does seem a likely possibility on the surface.

Brookfield: There has recently been a study on the lime resources of the Territory by the Building Research Unit of the C. S. I. R. O. Limestones of the Chimbu area were included. There is a possibility of using this lime in small kilns. The general conclusion seems to have been that because of difficulties in transport you can't do anything about the cement industry, but that there are many purposes for which you can use lime and there seem to be good prospects for this.

Chairman: It is impossible for any speaker here to give a precise answer to any particular proposal, but there is no doubt whatever that in the long run the development of this area, particularly with the change over to cash cropping, will lead to the necessity to develop other employment opportunities. Most people would agree first things must come first, and attention to the kind of problems being discussed this morning come first. The use of local timber, the harnessing of power, these things must come. The question is when.

Community development and the Chimbu

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Introduction

The Chimbu Division is one of those areas of New Guinea said to be either overpopulated or nearing overpopulation. For this paper I regard overpopulation as existing when the density of people on their land is such that they cannot maintain their standards without degrading their land resources. Those parts of the Chimbu where this problem is thought to be most pressing are the census divisions named Mitnande, Niglkande, Yonggamugl, Sinasina, Waiye, Dom, Wikauma and Marigl.

Despite a number of surveys I think it is true to say that overpopulation as defined above is not yet proven: however densities are high (in some places over 500 per square mile) and the present state of knowledge certainly requires the Administration's attention. The population of the above census divisions seems to be increasing at about 1.5 to 2 per cent each year. If this trend continues for even ten years the land will be supporting many more people - if they all stay at home. Among the Tolai of New Britain and the Mekeo of the Central District increases are about 3 or 4 per cent per annum.

Development

The Administration is committed to improving the standard of living of the Chimbu as a general aim, and can point to a long list of achievements. Overpopulation requires a further effort however as the normal methods and tempo of development will not necessarily meet the special needs of overpopulated areas.

The body of ideas called community development has been used with some success in some situations in the task of overall development and thus it could be regarded as being of potential use in the Chimbu situation. Some important aspects of the Administration's work to date has, in part, embodied these ideas.

What does the term mean? It can be regarded as proposing an end (or aim) sometimes alternatively expressed as the development of communities of people, or villages, in their political, economic, social, and cultural aspects. This does not take us very far as most governments concerned with low-income people would claim to be doing exactly this. Another way of regarding community development as an end or aim is the attempt to produce in the people a wish and a capacity to play a major part in the identification and solution of their own problems. At its worst this view postulates the almost magical emergence of brotherly love among men and women focused on community centres established on the initiative of the central government. Failures along these lines are more common than successes. At its best this view of community development is promising, as it comes to grips with a vital problem of administration - how to fit existing community ambitions into development programmes and how to stimulate static or dormant communities: thus maintaining a good tempo of healthy improvement.

If one adopts this view of community development (and it is worth adopting) one must then face the question of how to achieve this end. This introduces the second meaning of the term 'community development' which is that it describes a means or a set of administrative techniques or methods and is thus used as an adjective phrase preceding either 'methods' or 'programme'. The term may thus be used as either a noun or an adjective - meaning either an end or a method. Unless this dual usage is kept in mind a good deal of confusion can result.

In this paper I am assuming that the end sought or the aim of the Administration is community development, and will be concerned to discuss means or methods.

What are community development methods and what are the community development programmes to which they lead? The methods should involve people to the maximum in the identification and solution of their specific problems. This is the old principle of self-help, but more than the provision of endless quantities of unskilled labour, it also means encouraging people to make their own decisions both in the identification of ends (that is, which projects they want) and in the implementation and operation of these projects.

The modification of Chimbu life away from that of tradition towards attitudes, values and practices in harmony with the best of the twentieth century, both ethically and materially, is a process of social change that started up to thirty years ago. The changes involved are very profound ones in the light of the point of departure and the presumed target and they involve big personal and institutional adjustments. Influencing this process makes big demands on the Administration if it is to ensure its direction and tempo produce the most constructive results. The Administration claims prime responsibility for this task. What we see as a process, however, does not necessarily appear in that form to a Chimbu. Perhaps he thinks of a series of situations in which he has more or less choice in the adoption of a new attitude, or technique, or institution that may be proffered consciously by the Administration or may emerge as a possibility in a situation. The relationship between this choice and former and subsequent ones is not necessarily perceived or, if it is, it may well be in terms different from ours.

Our development administration can be matched to this view of the social processes involved if we think of development in any one area as being embodied in an area development programme and this programme consisting of a series of projects each involving a community. Each of these projects involves for the community on which it is based the adoption of an idea or an institution or both. These projects are usually village aid posts, village primary schools, community technical schools, branch roads, co-operative societies, cash agriculture, village clubs, village water supply, literacy classes, local government councils, cottage industry, stocking raising resettlement schemes, etc.

If it is to maximise the tempo of development among the people of an area the Administration must do three things relating to the people of that area. It must have reported to the authority charged with development in that area all community (or individual) ambitions as soon as they are manifest: where ambitions are not fully rational or not properly crystallised out of a simple vague desire for advancement it has to help the individuals or groups concerned to find a rational basis for their ambition or to shape it into suitable form: and it must find ways of stimulating static (or dormant) communities. It is not necessary to get too deeply involved in the detail of function, organization and training of staff to ensure the above

activities are performed: present field staff in the Chimbu with some retraining and reorganization could do this. The skills embraced in the term 'human relations' have a large part to play in these processes. This day to day contact with communities, properly organized, should do much to produce projects based on felt needs which could then be arranged into area development programmes. However it must remain in mind that maximising people's participation in their own development starts with letting each community choose to adopt or reject any project and where any community decides to stay outside, for the time being, formalised pressures should not be used to bring it in. Stimulation and indirect 'social' pressures can play a big part in this respect.

It may be argued that, in the Chimbu, if the tempo of development is governed by this principle of willing participation, the situation would immediately stagnate. Conversely it is held that if the Administration knew of all ambitions among communities in the Chimbu that could take the form of community development projects, it would be overwhelmed and would be hard put to find the complementary resources (i. e. teachers for schools, orderlies and supplies for aid-posts, etc.). In practice a balance could probably be found particularly where the principle of self-help is used; and New Guinea peoples have proved they are prepared to help themselves when their interest is aroused.

It is also true that some ambitions inevitably seek a non-rational expression and become cults. There is no quick and neat answer to these situations: each successful project in an area supports the rational elements. However, whilst the Chimbu have shown small interest in cults, they have displayed a readiness to work for their own improvement along rational lines.

Maintaining satisfactory contact with all communities is not the only aspect of development administration. It is necessary to arrange machinery that provides that all agencies of development in an area, that is government departments and voluntary agencies such as missions, are so co-ordinated that their work is not overlapping or competing and thus wasting scarce resources. The development of a community is one process with several aspects and not a variety of processes and

unless co-ordination is good enough to make it appear as one 'administration' programme rather than a series of departmental programmes, resources are wasted and momentum lost.

There is no simple answer to this hoary old problem. Government departments traditionally value their autonomy and denominational missions are frequently in rivalry. It is clear that the real sufferers from any failure here are the people trying to develop themselves who do not receive the help they should.

Much has been written about this problem. I believe the answer lies initially in an area development authority composed of on-the-spot representatives of the departments involved in development. This authority would have the right to consider all projects sponsored by any department prior to their implementation by that department. Assuming such an authority functioned smoothly under a skilled chairman (who would be the senior generalist officer in the area) it could not fail to raise the level of co-ordination and would inevitably be drawn into forward planning. Although its membership would be primarily public servants, the voluntary agencies working in the area should have their representatives drawn into its work. Such a body could operate in the Chimbu. At the next level down local government councils every day prove they can be effective instruments for the co-ordination of development in their areas. At the appropriate time, politically, the area development authority could evolve towards a more representative nature. Area co-ordination and planning can probably be fully effective only in a context of territory co-ordination and planning. The current interest in the United Kingdom in regional development bodies is worthy of note in this context.

If this idealised pattern of administration is achieved each of the census divisions (sections) of the Chimbu would evolve its community development programme based on the felt needs of each community. In this context 'community' is synonymous with 'group' in a sociological sense rather than with 'village': which in any case in the Chimbu is frequently an administrative device. Any community's view of its own needs is not necessarily the same as the more detached appraisal made by outsiders, be they a team of professional workers or officers of the central administration. Even where

there is some common ground in these two assessments the sequence or priority of needs may not agree. In the Chimbu today many would think the overpopulation and child malnutrition were the priority problems and indeed they may well be. However unless the people involved - that is the parents of the sick children and those with insufficient land - see that these are problems demanding early rectification we cannot expect wholehearted co-operation if we pursue solutions to them. The same people may, alternatively, work very hard on a project that they consider important. If we believe a sufficiently large social evil exists and its solution requires a positive contribution by the people we can endeavour to ensure their participation by provision of a legislative sanction at either local or central level. Alternatively, if we believe that this will be cumbersome and will not really do anything about the root of the problem which is ignorance and conservativeness, we will have to direct our efforts towards encouraging the people concerned to see the problem in rational terms. This may slow up the process but if the changes we seek do not occur the project in fact will have been foisted onto people and, being without roots in them, will be only as successful as external pressures make it. The use of native leadership will not necessarily help in this situation. If it remains unconvinced about the value of what we attempt it will be on the side of avoidance. If it tries to help us (having been convinced) it runs the risk of separating itself from its public support.

The use of sanctions may change people's behaviour but will not change their beliefs. On this simple truism rests the proposition that a community must make its own rate of change if the process is to remain a healthy one.

Special measures

The foregoing has been mainly concerned with general considerations of development in the Chimbu, but briefly referred to the possibilities of special measures required by infant malnutrition and overpopulation. Two points seem relevant to the general background of special measures. The Chimbu is not the only part of New Guinea with these problems. And any measures undertaken will not be effective if population continues to increase more quickly than production: nor will the transfer of people provide an answer unless the rate of

increase at the source falls. This involves the matter of family planning which may not enjoy universal support or understanding in the Chimbu.

However, assuming community development methods lead to a steady improvement in living conditions in the Chimbu, they could also endeavour to interest people in a special range of projects directed towards relieving pressure of people on land. These are, better land utilisation, and resettlement, either local or distant, or urban or rural.

Better land utilization could take two main forms; either the introduction of new crops (or new varieties of existing ones) or more effective methods of cultivation. Government efforts could alternatively be directed towards a rapid conversion of existing native agriculture from a subsistence to a market basis. This assumes that crops could be found for which a market is available and that would provide a more valuable return than that from current subsistence activities.

None of these possibilities seem particularly feasible. Those who know Chimbu subsistence agriculture best underline its technical efficiency and its harmonious integration with other aspects of Chimbu life. There may be scope for the introduction of more economic varieties of existing crops: however it would be rash to assume that the economics of such an introduction would automatically commend it to the people concerned. Non-economic factors may weigh against their adoption.

Any attempt to convert Chimbu agriculture to exclusive market production is even more fantastic. The Chimbu culture is tightly built around the present system of agriculture, practised for many generations. Agricultural revolutions probably have occurred. It seems likely that the Chimbu adopted sweet-potato as their main crop a lengthy period after their neolithic revolution. However, although the current beginnings of the diversion of resources from subsistence to market agriculture may be the commencement of a revolution of a similar order, there seem to be few prospects of completing this revolution in a short period.

Local rural resettlement, i.e. movement on to land

close enough to one's village to enable connections to be maintained therewith, has been reported in the Chimbu. It is doubtful, however, if it is or could be of a volume that would contribute to a solution of the problem. Those thus resettling themselves normally move to an area in which they have an existing relationship with the land owners and their occupation is on the basis of traditional land tenure.

In addition to this spontaneous resettlement it is possible that planned resettlement on areas close to the Chimbu may be undertaken. Limited areas with some possibilities await investigation although the investigation of the Bomai has been disappointing. Withal, some spontaneous migration to it has been taking place from the Marigl and Wikauma areas.

The Chimbu valley is ringed by mountains even less hospitable to homo sapiens than is the valley itself, and the scope for this type of resettlement seems limited.

Distant rural resettlement differs from the former in that the settlers are so remote from their home villages that day-to-day ties are severed and the settler has to build his new life in isolation from his relatives and home support - even if he takes his wife and children with him. A few Chimbu are squatting here and there throughout the Territory but their initiative cannot be expected to lead to a planned solution of the problem - rather it could become a default outlet.

For several years the Administration has been acquiring by normal processes tracts of land surplus to the owner's requirements and sub-dividing them for small farm development. The farms are intended for indigenous settlers and the aim is a prosperous peasantry. Recent variations, I think, provide for more ambitious and able individuals to commence a conversion to 'estates' employing paid labour - in a small way of course: but interesting results may appear. A very small number of Highlanders, on their own initiative, have been granted leases in these schemes.

It seems likely that if large scale resettlement of Chimbu people is to be sponsored, it would have to be on this planned basis leading to individual tenure. As there appears to be insufficient land close to the Chimbu, it would eventually

result in the emergence of homogeneous Chimbu communities in various parts of New Guinea. Rapid political development and fears of regionalism might mitigate against this. Such resettlement would make huge demands on the capital resources of the Administration and the expenditure may not produce any quick return.

Local urban resettlement already exists in that Highlanders form part of the skilled and semi-skilled urban aggregations. What skills they have obtained have been largely the results of their own initiative although technical schools are now turning out some youths with skills, and sympathetic employers have been very helpful.

It is difficult to assess the expansion of opportunities in this category. Certainly as the dense highland populations become more productive so will the demand for tertiary industry (mainly services) grow and this will mean the growth of towns and more skilled employment. However there will be general competition for these jobs.

Distant urban resettlement is the eventual lot of many Highlanders who leave home originally to work in rural industries. As the need for health and other special precautions concerning the employment of Highlanders in the lowlands diminishes, it seems likely that more Chimbu than at present will yield to the attraction of city lights and make for the towns.

The scope for urban employment has certainly increased since 1945, and will probably continue to increase although, of course, this trend is related to the volume of investment in towns. New Guinea is entering what may be a period of political uncertainty and this may effect the rate of investment. However, if it does, the effect should be only temporary. If current signs are to be trusted the road towards self-determination in New Guinea promises to be a smooth one with a minimum of dislocation - if any.

An increase in confidence and this investment can perhaps be expected. The survey of the Territory, the field work for which was recently completed by a World Bank team, at the invitation of the Australian government, may help clarify

the problem. More investment will mean more jobs and doubtless many Chimbu will move into some of them.

Conclusion

The foregoing summarises the general and special approaches to community development in the Chimbu. The employment of community development methods and the build-up of community development programmes could help in raising the tempo and effectiveness of improvement of the Chimbu. As the process being more and more part of social change it could lead to a better understanding of and a desire to solve the problem of overpopulation - and then help in its solution.

It will not guarantee that the priority in which problems are tackled is the one we think most appropriate. This is unavoidable if our aim is to encourage and assist people to improve themselves.

Introducing peanut butter into Chimbu infant diet

June Anne Ross

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From August 1962 to June 1963 a pilot project was conducted in the Waiye Council Area with the principal objective of extending the peanut butter infant feeding project from the first hospital-centered stage, and the second clinic-orientated stage in which the Public Health Department supplied the grinders while the mothers brought their own peanuts to the Infant Welfare Clinics, to the third and final stage in which the scheme becomes a community responsibility with the people buying their own grinders through their local government council, growing and preparing their own peanuts, and bringing them to a central point for grinding.

More specifically, the objectives were:

- (1) To promote the use of peanut butter as a protein supplement in the diet of all infants aged six weeks and over.
- (2) To study customs of infant care and diet and related beliefs and attitudes including both those that are traditional and those adopted from Mission and Administration contact.
- (3) To determine the acceptability of peanut butter feeding and to learn whether it comes into irreconcilable conflict with any traditional beliefs and customs.
- (4) To study the existing situation as regards the cultivation, distribution and consumption of peanuts.
- (5) To encourage the growing of peanuts for home consumption rather than as a cash crop, and the cultivation of Virginia Bunch peanuts to the eventual exclusion of the more common Spanish Red and mixed varieties.

- (6) To determine the most effective methods of disseminating information among the Chimbu, and the means by which a change in food patterns can best be effected.
- (7) To present information on problems which could possibly arise in the promulgation of peanut butter feeding in comparable culture areas of Papua-New Guinea.

As has been pointed out, the Chimbu is deficient in protein and in calories. For this reason nutrition research is most important in the Eastern Highlands, and especially in Chimbu Sub-district, where extension work on the peanut project was incepted. The Waiye Native Local Government Council area was selected for the main phase of the pilot project. Initially effort was concentrated in the Waiye area, including six aid-posts, a grinding clinic at Mintima, and the hospital at Mingende Catholic Mission. Later, work was extended into the Koronigl Council area, and into the Kup, an isolated plateau south of the Waghi River between Minj and Kondiu.

With the advent of attempting to incept an attitude change of the food patterns of a people, it must be realized that the total culture of a society is integrated in such a way that what may appear to be only a small change in one aspect of culture will require adjustments in many related culture traits. A change in food pattern for instance, may involve the cultivation of a new crop, a change in garden methods, a strange mode of food preparation, and an adjustment in meals to accommodate the new food.

In some respects, the introduction of peanut butter in Chimbu does not require many major adjustments. The process has been made easier by past experience with peanuts - their cultivation at least is not a new and strange procedure. The process of culture change passes through three stages: changes of behaviour (superficial), change of attitude, and change of behaviour (customary). These are not so much stages as degrees of depth to which the change has become impressed upon the existing culture pattern. The ultimate object of extension work is of course the final stage - a change in customary behaviour. It may, and indeed usually does, take many years to achieve. The imposition of information, and instruction in an authoritarian manner, simply result in the first phase; as soon

as the authority is removed, the people return to their former pattern of behaviour. To achieve the second phase, a change of attitude, may take a long time; the people should be made aware of the problem and to realize that the solution suggested is desirable and preferable to the present situation. The third phase can only be brought about after this change of attitude, because the motivation for accepted and habitual behaviour must originate or be induced within the group. This may take many years to achieve because people, especially those in the higher age groups, are conservative, and the new concept may have to do battle in the minds of the people with a concept and custom firmly established by generations of traditions.

Avenues for induced change

There are several alternative means by which the extension phase of the peanut project in Chimbu may be conducted. Most of these methods were attempted either in the pilot project or previously. In considering the channels for dissemination of ideas it is well for one to be mindful of those aspects of acculturation afforded by Mission and Government which have been rejected, accepted, or to some extent emulated, and why. The best orientated agencies for the dissemination of such ideas at this time are Infant Welfare Workers, Hospitals, Aid Posts, Councillors, Missions, recognized leaders and spokesmen, informal discussions, schools and teachers, agricultural workers, and concentrated Government projects.

In the early stages of the peanut project the Infant Welfare Clinics had met with little success in the Chimbu area. Drum-tops and grinders were taken out on Clinics and the mothers encouraged to bring their own peanuts for cooking and grinding. Some women were issued regularly with a free supply of peanut butter. The Infant Welfare Service made little impact with this programme at the first because (a) male authority is all important in Chimbu society, and, although the clinics are often held at Aid Posts, with an Aid Post Orderly assisting, he does not lend sufficient male support to the programme; (b) the Clinics come into contact with only the women of the community, whereas it is the men who first must be educated and converted to a new idea which when accepted they will pass on to their womenfolk; (c) the Clinics, being transitory, have insufficient time to help the people in alleviating the lack of locally grown peanuts; (d) only a small percentage of

mothers attend a clinic, so that its range of influence is limited; (e) the Clinics are inevitably associated with the hospital, and quite divorced from the normal routine of the people.

Hospitals can be most effective in providing tangible proof of the value of peanut foods in improving the health and physical appearance of infants. But the range of the hospitals' influence is naturally restricted to a relatively small area. Perhaps this is an advantage, for it is most important that the peanuts-for-babies concept should not be associated with illness. In the case of a mother who is sufficiently acculturated to seek help at a hospital, it may be possible to convince her that malnutrition can be cured with peanut foods. To the average Chimbu woman, however, such an idea would conflict with her beliefs in the causes and cures of sickness. Where there is no obvious cause, illness is attributed either to sorcery, or to an offended ancestor spirit, or to the failure to observe some ritual practice. One instance of malnutrition near Mintima was said to have been caused by an omission in the mother's puberty rite; another was attributed to the mother's failure to kill her pig in the traditional 'pigs' graveyard'.

On the other hand, the 'health value' of certain indigenous foods is appreciated. On the basis of scientific evidence, the required nutritional properties for any benefit to health may not actually exist in the food; the important point is that there is an association between food and health. One example would be sugar cane, which is eaten for energy and strength; another would be 'strong' banana (tagemba), which a woman eats immediately after childbirth, to strengthen and tighten her stomach. So the idea of peanut butter to fatten and strengthen a baby does not conflict with traditional belief.

Thus, in the field, the idea of peanut butter to 'cure' sick and malnourished infants should be avoided; the emphasis in peanut propaganda must be on the 'grease' content of peanut butter which will be correlated with the likeness of pig 'grease'. The fat of the pig carcass has a high prestige value as a food. There should be a sharp line of demarcation between the work of the hospitals in malnutrition and extension work aimed at all infants in the community, both healthy and sick. It would be preferable that extension workers avoid any association with the hospitals in the minds of the people.

The pilot project in the Waiye area was initially conducted for the most part through the Aid Posts, with delegation of authority and certain responsibility to the Aid Post Orderlies. It was concluded that Aid Posts definitely do not constitute the most effective means of promoting peanut butter at the village level. Several reasons for this are suggested: (a) the Aid Post is associated with sickness, and a mother should not be made to feel that she is giving her baby peanut butter because it is sick; (b) the Aid Posts in Chimbu are by no means an accepted institution. The efficacy of European medicine is never doubted, yet the people do not always want to believe in it, as its methods are contrary to those of any traditional belief; (c) the A. P. O. has little status in the community. He can never 'sing out' as the Councillors and recognized leaders do - he would be ridiculed if he did. Consequently, unless he has the support of these 'big men', he cannot summon people to any communal activities at the Aid Post, or to help him with work in the peanut seed gardens; d) the Aid Posts are not the best location for the peanut seed gardens. The ground is invariably the poorest plot in the area so that maximal yields are not obtained; and the land for an Aid Post becomes Council property, so that no-one feels individually responsible to help the A. P. O. in its upkeep. Peanut seed is best distributed to individuals for planting in their own gardens, or given to a leader who has offered a large tract of land and who has the authority to call upon people to help in the cultivation; e) all activities conducted at an Aid Post and in the open clearing before it (First Aid, Infant Welfare Clinics, Councilor's 'Courts', coffee-buying, lucky games, and Council meetings) are European-introduced. No traditional institutions such as marriage ceremonies or food distributions are ever to be found there. Conversely, the traditional meeting-grounds are not 'contaminated' by borrowed institutions. It is obvious that to ensure the lasting success of changing a food pattern, it must be integrated with the existing culture pattern and divorced from European-orientated activities and concepts.

Agricultural workers and officers and assistants are highly regarded in Chimbu as they are concerned with one of the most important aspects of life in Chimbu - subsistence gardening. Moreover, they are concerned with cash cropping, possibly the only European innovation which, unlike Christianity and the cessation of tribal fighting, has given the people the hope and the means of acquiring material wealth. Agricultural workers in the

field can greatly assist the peanut project by the distribution of seed, and by advising on the best methods of peanut cultivation.

In reviewing the effect of schools it must be pointed out that the children in Chimbu exercise little or no influence in the home. Health habits and hygiene that they have learnt at school are soon forgotten, and it is doubtful whether anything they have been taught is transmitted to other members of the family. However, in some well-organized boarding schools and mission schools, with their own peanut gardens, the installation of a peanut grinder could prove worthwhile. It must be remembered that in several years' time, those children given peanut butter at school, will have families of their own.

The value of working through a mission depends on the degree of influence it has upon the lives of the people. The more lasting reforms and inroads in the people's culture have been incepted by the Missions. The sympathetic approach of Father Nilles in his efforts to blend the old culture with the so-called new culture, is not unappreciated by his vast Chimbu following. The approval and active backing of Father Nilles and the Mission has reinforced to some extent our own educative efforts made under the auspices of the Administration. Such co-operation, as was experienced at Mingende, serves to illustrate how close liaison between a mission and the Administration can be of benefit in reinforcing a change of attitudes and customs.

Techniques inducing change

Informal discussion proved to be the most effective method of disseminating information on peanut butter feeding, in conjunction with repeated demonstrations of peanut grinding. One of the great advantages of living in the field is that one can maintain a close and informal relationship with the people, which is essential in this type of extension work. Little can be achieved by 'lecturing' the people and assuming an authoritarian attitude.

Recognized leaders and spokesmen are the so-called 'big men' with whom work was done with in the Koronigl Council area to organize the 'peanut houses'. It should be explained that a peanut house is a simple structure very comparable to a coffee house, the latter being a great centre of interest as this

is where the coffee buyer will make his purchases of coffee from the people. Generally, the peanut house is built on the formerly used ceremonial grounds, or as close as possible. The idea is that the members of a 'line' (usually a clan section), under the supervision of the recognized leader or Councillor, construct a small cane shelter to house a drum-top stove and a peanut grinder, the latter being purchased by the people themselves. The fact that the group actually own and maintain their own grinder has largely contributed to their interest in the scheme.

It is most important that the locally recognized leaders and spokesmen are identified, for often the case is one whereby the Councillor is in fact only a 'go-between' for the real leaders. Sometimes they are the authorized hereditary leaders of a sub-clan, sometimes they are men who are leaders by nature, and sometimes they are the nominal leaders representing a clan section in the Council. But they are the men with real influence, their opinions are respected and their example often followed.

The assistance a Councillor afforded the scheme varied from one individual to another, according to their degree of interest in the project, and the extent of respect and authority they had with their 'line'. A 'line' corresponds approximately with a clan section, and usually one Councillor represents the members of one clan section. Again, it would appear to be imperative that the actual leaders are recognized and their co-operation enlisted.

Summary of favourable and unfavourable factors in acceptance

In conclusion, it may be said that (1) the project had the initial advantage that peanuts were a familiar food crop in Chimbu, so that their cultivation was not a new and strange experience requiring major adjustments in garden practice; (2) one of the customary methods of cooking peanuts in the home is suitable for use in the preparation of peanut butter; (3) peanuts have fortunately not taken on any magico-religious significance (as have many indigenous foods), which might complicate their use in infant feeding; (4) even where peanuts have supposedly replaced the pig in areas of some mission influence, they have not become a status food; they are used in food distributions, often in vast quantities, yet seldom comprise

part of a marriage payment or a death exchange; (5) peanuts are popular as a food with all members of the family in Chimbu; they are eaten frequently as a snack rather than with any meal; (6) maximum effort was concentrated on encouraging the concept of peanut butter as a baby food - whole peanuts are a good food for everyone, but peanut butter is 'mushy' like the indigenous weaning foods, and is not suitable food for grown men and women; (7) in the Waiye area the cultivation of peanuts has been largely displaced by coffee cash-cropping; the lack of peanuts and the reluctance to give valuable garden land for seed plots hampered the project in the early stages; (8) in the case of those families who were willing to put some of their land under peanuts, the distribution of seed was most successful, with the harvests resulting in increased attendance at all grinding clinics; (9) due to its inception at the hospital, and its promulgation through the aid-posts, the peanut-butter-for-babies concept is in some areas associated with sick infants only, and at first only the undernourished infants were brought to the grinding clinics; (10) in Chimbu, authority is vested in the male - he makes the decisions on all matters of importance, which necessitates his conversion to an idea first, before the extension worker can enlist the participation of his wife; (11) the nominal leaders in the group are not always those men with the most influence and authority in the community; (12) grinding clinics established at aid posts proved less successful than was anticipated; time and effort should, to some extent, be continued, but gradually lessened as other avenues of extension work are proven more successful; and (13) it is felt that the most effective method of promoting the peanut project has been by informal discussion with the recognised leaders and spokesmen who, with the members of their clan sections, have been given the responsibility of buying a grinder and maintaining it for communal use.

Recommendations for future action

It may also be said, in conclusion, that (1) all hospitals in the area using peanut butter in the treatment of malnutrition cases should have their own peanut gardens so as to be completely self-sufficient; (2) in an area where peanuts are not plentiful, seed should be distributed in small amounts to families for planting on their own land; (3) the help of agricultural extension workers should be enlisted for this distribution of seed and for advising the people on the best methods of peanut

cultivation; (4) only the Virginia Bunch variety of peanut should be used in seed distribution, and the replanting of mixed varieties discouraged; (5) it is preferable that seed gardens be on individually owned land rather than at aid posts or on Administration land which is not usually very productive; (6) before attempting to introduce the peanut project in an area, a short study should be made, either by means of comprehensive questionnaires or by a trained fieldworker, to determine: (a) in what ways if any, certain aspects of the scheme may conflict with relevant customs and attitudes, and (b) which methods of extension work would be likely to prove most effective in that particular culture group; (7) if peanut butter is to be promoted as a supplementary food for all infants in the community, it should not be introduced to the people as a 'cure for sick undernourished babies' but as a 'good food to make babies fat and strong'; (8) in an area where Infant Welfare Clinics are well attended, and where men are not the dominant sex to the extent they are in Chimbu, the Clinics could be an effective means of promulgating peanut butter infant feeding; (9) similarly, in an area where it is admired for women to be 'progressive', Women's Clubs could be of value in the dissemination of information; (10) where Missions are influential, their active support should be enlisted; (11) preferably, however, extension work should be aimed directly at the village level, whether Councillors or not, who can be given responsibility in the project; (12) in less sophisticated areas, drum-top stoves can be distributed to these leaders, for communal roasting of peanuts and also to serve as status symbols for these men; (13) unless there is a ready surplus of peanuts in an area, the project should be aimed initially at infants, and the concept of peanut butter as a baby food inculcated upon the minds of the people; and (14) wherever possible, the addition of salt to the peanut butter should be avoided as it makes it more palatable to adults, and in many areas it is a medium of exchange which would be thought unsuitable in a baby food.

Experiences of peanut feeding in the Chimbu District

Noah Temgwe

(Department of Public Health, Territory of Papua and
New Guinea)

I was born in Roussel Island twenty-seven years ago. Roussel Island is a small island of approximately 130 square miles situated on the far eastern tip of the group of small islands that lie close to New Guinea's tail. Roussel Island is a quarter of the size of the Chimbu area of the Eastern Highlands and has 1500 people as against 162,000 Chimbos. My mother still lives in a village called Damunu but my father died when I was six years old, and I have one brother and one sister also at Damunu. I started at a small school in my village at the age of six years and then was sent at the age of eleven years by the Methodist Mission to a larger school at Missima Island which is two days journey by boat away. This was a large boarding school of over 200 pupils and here I spent three years up to Grade III.

When I was 14 years old I worked as a Government hospital orderly at Misima hospital learning medical work, treatments dressings and so on. After two years there I decided to go back to school. I went to the Government school in Misima where I stayed one and a half years and passed Grade V. Then in 1956 the Government sent me to the Sogeri high school close to Port Moresby where I stayed two years and passed Grade VII.

In 1958 I joined the Papuan Medical College where I stayed for four years; for the first three years learning the work of a hospital assistant. This consists mainly of nursing duties and is similar to the training given to trainee nurses in Australia, with a bigger emphasis, of course, on tropical diseases. After three years' training I did a further year's course for a medical assistant including two months' field work at Goroka. I graduated a trained medical assistant in April 1962, and was posted in May of that year to Gumine. I was one of the first batch of graduates from the medical assistant's course.

At Gumine I was in joint charge of a 100 bed native

hospital together with a fellow graduate medical assistant Mr. Toule Tarabi who comes from Finschhafen on the New Guinea mainland. Gumine is a base hospital serving a population of 40,000 and the outlying areas being served by fifteen aid-posts in the care of Aid-Post Orderlies. These are Grade 2 or 3 men trained in elementary first aid, and the treatments of such tropical diseases as malaria, dysentery, scabies etc. and other diseases such as pneumonia. They give penicillin injections, nivaquin tablets, do dressings and so on, and only refer the sicker patients to Gumine hospital.

At Gumine the main diseases treated are malaria, pneumonia, infected scabies and other like skin diseases, traumatic cases such as burns, lacerations and fractures, the odd case of leprosy and a few cases of cirrhosis of the liver probably of dietary origin. Hookworm and round worm infestations are almost universal and probably lead to a lowered resistance to other diseases such as malaria and pneumonia, but do not alone cause many deaths. Malnutrition is reasonably common and a few of kwashiorkor are also seen.

At Gumine Mr. Toule Tarabi and I started using peanut butter, peanut balls and a combination of peanut butter and banana or peanut butter and sweet potato for cases of malnutrition, late in 1962. Previous to this the only supplementary feeding given had been milk (tinned full cream or non-fat milk) and casinal powder.

After introducing peanut butter as a supplementary food in Gumine, I was transferred to Kerowagi, also in the Chimbu area, in early 1963. Kerowagi is a 90 bed hospital serving 27,000 Chimbus with a similar disease pattern as at Gumine, but rather more admissions from malaria, as Kerowagi includes the eastern end of the Wahgi river flats, where malaria is much more common. At Kerowagi I have 14 male hospital orderlies and two female hospital orderlies and 13 aid-posts in the Kerowagi sub-district itself.

At Kerowagi under instructions from Dr. Tuza I introduced peanut butter as a supplementary feeding to malnutrition and kwashiorkor cases. This had not been tried at Kerowagi before, the only supplementary feeding given being milk and casinal as in Gumine previously.

All cases of malnutrition, mainly the older infants (one to 2½ years) deprived early of their mother's milk supply by a new-born brother or sister or perhaps by sickness of the mother, were given peanut butter produced by grinding previously roasted peanuts in a hand-operated Beatrix corn mill. The peanut butter produced by this grinder is a rather darker colour than the bought Sanitarium peanut butter, but has about the same oily consistency. This is either given as a peanut butter ball about the size or a little larger than an egg held by the infant in his hand or is mixed with mashed banana or boiled kau kau and fed with a spoon. Another method of presentation is to give a liberal filling of peanut butter inside a split banana as a sort of sandwich.

In the main children like peanut butter either as a straight peanut butter ball if they are old enough to hold in the hand, or as peanut butter sandwich with a split banana as the 'bread'. Peanut-banana as a mushy spoon-fed mixture is less popular, possibly partly because the mothers are not used to spoons and the babies perhaps also resent this method of feeding. It must be remembered that all food apart from breast milk is eaten by hand - if mushy such as boiled pumpkin, then eaten off a banana leaf or some such leaf, if firm such as corn or sweet potato eaten as we would a cake held directly in the hand. A spoon is alien to the indigine and this may account for some difficulty with the younger infant and the spoon-fed banana-peanut butter mash.

However peanut-banana is fed to infants from the age of three months and after initial problems most of the younger infants accept both the mixture and the spoon. Older infants being used to a handful of cooked sweet potato take to the peanut ball and the banana-peanut butter sandwich held in the hand very well.

The peanuts at first were bought at the twice weekly 'bung' or market held at the hospital where sweet potato, greens etc. are also bought. As this supply was rather inconstant - sometimes too much, sometimes too little - I arranged for guardians of hospital patients to plant two large plots of peanuts each about ½ an acre in extent, and by mid 1963 these were productive. Peanuts take between 3½ and 5 months to mature at Kerowagi which is 5,250 feet above sea level. Since then another hospital plot has been planted but is not yet ready to harvest.

Since September 1962 four Papuan and New Guinean trained nurses have been stationed at the Kerowagi hospital taking the place of European sisters who were based at Kundiawa (17 miles to the East) and who had previously held infant welfare clinics in the Kerowagi area.

Since these local girls have taken over the clinics at Kerowagi, the number of clinics held has been increased from four a month to sixteen clinics held in the villages and four held at the hospital for local Kerowagi mothers. The number of babies and children attending the clinics has increased from 490 under five and 44 over five to 2, 528 under five and 1, 238 over five.

Peanut, in the forms above, has been used by these Papuan and New Guinean nurses since May 1963 as a supplementary feeding to babies seen in the clinics. The mothers are encouraged to bring roasted peanuts (generally cooked either in a stove or tree-trunk mumu oven, or on old 44 gallon drum tops) to the clinics and the nurses grind them into a peanut paste for the infants. In actual fact very few peanuts are brought into clinics, and whereas mothers with malnourished babies will demand peanut butter for their babies when they come into hospital, they seem at present to associate the peanut feeding with sickness rather than health.

It is hoped that the example of successes in the hospital will slowly overcome this prejudice and encourage the mothers to use peanuts more and more for well babies as a protein supplementary feed. Some success along these lines has been encountered at Kundiawa, where full time Europeans for over a year and now a trained New Guinean health educator have been promoting peanuts as a supplementary feeding for healthy babies as well as cases of malnutrition.

Considering that I have a 90 bed hospital, 13 aid-posts and 27, 000 people to patrol and see at least once yearly, a hospital demonstration of the value of treating malnourished children with peanut butter, combined with discussions between the clinic sisters and village mothers, is the scope of my effort to encourage similar change of heart in the Kerowagi area. However the programme has only been introduced into Kerowagi for seven months at the present time and good progress in hospital use and acceptance is already evident.

Discussion (following Mr. Temgwe's paper)

Unknown: Do the peanuts have to be baked and ground to be of any nutritional value? I have seen children in New Guinea bringing fresh uncooked peanuts to school as play lunch.

Bailey: Proper processing with a grinder is very important to produce a fine paste. The more roughly ground peanuts, such as are produced in an ordinary household mincer, are not properly digested by infants, children or adults. I believe that the only way to make peanuts digestible for infants, children or adults is to roast them as described in my paper and to grind them with the Beatrix Mill, or an equivalent processing. With all other methods we have found difficulties.

Chairman: Is a raw peanut of any nutritional value?

Bailey: I cannot say that it is of no value, but I can say that it is of positive harm in a percentage of cases.

Unknown: Surely cooking and baking will destroy a number of vitamins in the peanuts or in other ways harm them.

Bailey: It does not destroy the protein value, it improves it, by destroying the trypsin inhibitor.

General discussion
Chairman, Sir John Crawford

Professor Thomas Stapleton: The remarks by Mr. Tomasetti reflect the practical approach of those working in the Territory. On a recent visit I was struck by the remarkable speed with which the Administration has been coping with the problems of the Chimbu area. Some speakers have implied that development has been going rather slowly, but having visited other areas with similar difficult terrain where efforts have been made over longer periods to change the condition of the people, I could not agree that the advances have been slow. The commonsense attitudes of the Patrol Officers and the A. D. O's have been important contributory factors in progress. Certainly one of the difficulties has been the frequency of changes in staff, so that sometimes something started with enthusiasm by one person has not been continued.

Mention has been made that there is only one qualified doctor in the Chimbu area. This disadvantage is off-set to a considerable extent by the good quality of the indigenous New Guinean medical assistants, who display clinical acumen and keen attention to patient care. They confirmed the impression that has been gained in many under-developed countries, that much of what is needed to give essential medical care can be learnt in a comparatively short training period. Indeed, a person who understands the people may be much more effective in situations like Chimbu than the more sophisticated person who finds it difficult not to compare local conditions with those which he has been used to in a technologically developed society.

The suggestion that the adoption of European clothing should wait on the development of hygiene is sensible. For many years to come, the people of the Chimbu will not have housing or washing facilities suitable for the widespread introduction of European clothing.

Several speakers have indicated that the Administration should have greater financial resources at its disposal. There is no person developing anything anywhere who cannot do with more money, but if more money is to be made available it is important that the priorities in its use are correct. Although I am a paediatrician, I would put increased expenditure on

medical care low on the list of priorities, with roads, education and agriculture at the top. The provision of these facilities is, if looked at other than in the most short-term way, going to be of greater value to health. This is recognised in the following quotation from the review of the Director of Public Health for the Territory in his Annual Report 1962-1963:-

' The increase in the numbers of trained indigenous staff has allowed a significant shift in emphasis to public health activity, and at the same time laid the foundations for a medical service that this country can afford.

There are many roads to good health. Better health follows successful economic ventures and better education, and always the health worker must be alert to recognise and encourage progress in spheres not directly associated with health aims, but in the long run perhaps bringing better net health gains. '

In some developing countries those who have become educated have tended to feel that they are too superior to do manual work. Thus, in the provision of more education, the slogan 'Education with Labour' might well be applied, so that he who has become literate does not consider that he should confine his activities to the office desk.

Chairman: I am glad that Professor Stapleton has spoken as he has, because he has reminded us that the subject of this symposium is 'an integrated approach to nutrition and society'. He for his part has suggested certain priorities.

Sir George Currie: We found that the people did recognise that education for health should have a high priority in the development of higher education but it was gratifying to me, since I was once a Professor of Agriculture, that they usually put agricultural education first in their list of priorities! After that they usually placed medical men to cure disease as the next choice and then teachers, engineers and scientists. They had a very practical outlook on higher education. They wanted first the professional and technical training which would help to develop their country and the health training to reduce the load of disease.

I'd like to ask firstly, what is the attitude of parents in the

Chimbu towards the education of their children and more particularly towards the education of their girls? Secondly, what has been the experience, particularly in the Highlands, of the introduction of the soya bean? This bean has been so very useful in many parts of the world that I'd like to know its present status and likely future as a crop in the Territory? Thirdly, does the panel think that the ordinary machinery of Government is not enough to ensure integration of development and if so what better means could they suggest to ensure a more effective integrated approach to the development of the Territory and the well being of the people?

Brookfield: Professor Stapleton suggests that the rate of progress may be satisfactory. Assessment of a rate of progress is subjective and depends largely on where one has been previously, and on what comparisons one makes in one's mind. I have not been to the Himalayas, and would not compare New Guinea with remote corners of the former British Indian Empire. I would think for example of Kenya, or of places nearer home such as Fiji which have progressed very much faster. Professor Stapleton and I must agree to differ on this subject. On the question of priorities, on the other hand, I find myself in complete agreement with what he said. I feel that the needs of economic development and of communications are paramount: indeed, I would put communications first. Sir George has posed the question of what sort of an Authority I would suggest to achieve an integrated approach, and whether this Authority should be inside or outside the Government. This is a very large question, and I would not wish to appear dogmatic in answering it. Community development programmes in the manner outlined by Mr. Tomasetti are being carried out in many parts of the world, but not always as part of an organized plan. I believe that in New Guinea there should be something like a National Development Authority, with over-riding powers, and that it should have seconded to it members of the staff of different departments such as Native Affairs, Agriculture, Works, Public Health and so on. Such an Authority should have the task of drawing up priorities and getting things moving as energetically as possible, and of course it must be provided with sufficient funds.

Brown: Chimbu parents want their children to have a higher standing of living; they want them to ride in cars, to wear nice clothes, live in nice houses, to have money to spend in the

shop, and so on. They know that this does not come out of a subsistence economy, and they know that those people who have had training, and are in jobs as drivers, clerks, carpenters, and other jobs with the Administration, have more of these things. This is as far as their horizon goes. They never see any other sorts of skill. They know that amongst the better trained people are the teachers in primary schools. They hope that their children may take over this kind of job, but they really have no clear conception of what education means except in the general way to prepare them for a better kind of life.

Dick: We have been growing soya beans in the Highlands ever since the war and they do very well. We have trials going at the 7,000-8,000 ft. altitude levels which are too high for peanuts, and I think it is very likely that soya beans will grow successfully there. At the 5,000 - 6,000 ft. altitudes the soya beans are growing very well and yields are up to world standards.

Tomasetti: An ideal system would require 2 or 3 levels of planning. The choice is not between a regional or a central planning authority. Both are needed. However I emphasise that planning must be done as close as possible to the problem by the representatives of various departments and the people on the spot. Those who are responsible for the implementation of the local planning should have facilities for coming together in the planning. At the territory level there is a need for a policy deciding body. This should be serviced by a planning secretariat. If an outside body is to plan at district level we will be complicating the problem immeasurably. The main principal in community development programmes is not that public servants should look at an area and determine its needs as they see them, and then try to clamp their programme over the area, but that the people who are being developed state their needs. They may of course need assistance in doing this. These various projects are built up into a programme. Certainly central government planning will be necessary to provide the complementary resources. For instance, if fifty villages say they want a school next year they can't have one unless the central government has planned to have the teachers available and funds to help with the buildings. Planning should be within the government but delegated as much as possible to the people on the spot. However the whole process should originate from the people concerned.

Chairman: This is an extremely difficult question, made the more difficult because of the process of political development and change which is going on. I respect the views of Dr. Brookfield but I think the last thing we should do would be to establish a body with an over-riding authority. The real problem is the development of a sense of political responsibility. The New Guinea people must develop an awareness that resources must be allocated between different activities and between different regions. The Chimbu people, for example, may be relatively badly served as we learnt this morning. They are likely to be badly served unless there is some instrument in Port Moresby for reviewing allocation of resources between the various regions and not merely as between the functions: education, health, agriculture and so on. I strongly favour a Central Planning Authority for New Guinea. I also favour the gradual working into the Planning Authority the people who are to govern their own affairs. I cannot see any purpose to be served by setting up some extra-parliamentary body with over-riding authority.

Dr. Norma McArthur: It seems to me that before anyone starts talking about planning one essential requirement is better data on population structure throughout the whole of the territory. Of all the territories in the South West Pacific area there is only one that has worse population statistics. Population statistics does not rest with knowing the numbers of people, but in knowing how those total numbers are changing. For this you need to know very much more about the age structure of the population, more about mortality rates at different ages, and more about fertility rates. You can do something about this providing you have reasonable estimates of the ages of people of the population. Regarding rates of increase of the population I agree with Dr. Shand that improvement in the rates of death from malnutrition in children would make only infinitesimal changes in the present rates of population growth. However the eradication of the effects of malnutrition on pregnancy and lactation may have quite different effects on the rate of population growth. Fertility rate is a much greater determinant of population growth than is mortality rate. If this peanut butter is fed to women who are already pregnant there is not going to be very much change in the pattern of fertility. But it may well happen that if peanut butter is fed to them whilst they are lactating, this practice may ultimately have important consequences on the likelihood of subsequent conception. This would completely change the picture of

fertility rates. One of the things we know very little about are the social determinents of fertility. This is something that should be taken into account in planning community projects. The effect of the breaking down of tabus on sexual intercourse during lactation may have profound effects on the pattern of fertility and the future rate of growth of the Chimbu population. The populations that are increasing fastest in the world today are those where mortality rates have been reduced by medical techniques but where birth rates are high. In Papua-New Guinea mortality rates have been reduced but there has been no comparable effort to reduce the rates of fertility to levels such as we in Australia enjoy. I agree with Professor Stapleton that Health Services should be low on the list of any priority for Papua-New Guinea.

Kaad: Dr. McArthur's criticism of the statistics for Papua and New Guinea should be seen in perspective. We have over 2 million people in the Territories. The next largest population in the Pacific would be about 200,000. We must look at the lack of development in the Chimbu area in relation to the development of the Territory as a whole. The Chimbu area has only come into prominence in the last 20 years. Should we not give greater relative assistance to people who have had contact with Europeans since about 1880, and who have already progressed a fair way along the road of change? Should we, for example, send our agricultural officers along to a place which at first sight appears to offer little prospect of economic development? Should we, as has happened, send them to a place like New Britain where the cocoa project is bringing the New Guinean planters an income of about £1,000,000 a year? These are priorities which must be faced. Everyone will agree that development programmes must be integrated. Mr. Tomasetti did not touch on two aspects very deeply. One is the question of finance. The Regional Development Committees must have some funds with which to work. The other aspect is that you must have the people on side. The government officers, assisted by scientists, must be able to give the people a series of alternatives. You can't simply go along to people and say, 'What would you like to do?' However, an expatriate government officer will never get nearly as much done as will an indigenous officer who is properly trained. So you need a lot more money to spend at the local level, and you need more indigenous officers planning along these lines. This is happening at the

moment but people ask why has it not gone on before. For answer, one must look to priorities and find out what happened after the war. Then the first priority was given to health. This was probably because the expenditure of one shilling would cure all sorts of diseases and you could see something for the money. If money had been spent on education you could have spent hundreds of thousands of pounds just to get tooled-up, that is to get your teachers ready and get them out into the field. This explains why the educational system has been lagging. I feel strongly that some Central Planning Authority is necessary. Planning at the regional level cannot proceed unless adequate support is given from a Central Government Authority.

Brookfield: My comments on a Development Authority in relation to an integrated approach have been slightly misunderstood. I feel the need for a centralized Development Authority for the reasons that Mr. Kaad suggests, but also for an additional reason. While it is the New Guinea people must be brought into co-operative association with any central or regional planning authority, I would not feel happy at this stage about starting planning from the grass roots upward, on the lines suggested by Mr. Tomasetti. My reason is simply that I do think any plan would emerge this way. At this time I do not think undue fear of coercing people should influence our thinking. The Chimbu, like most people in New Guinea, are no strangers to coercion: they have been coerced for years. The Administration has coerced them since 1933, and in their own society they are coerced all the time. They know of no other way of getting anything done but coercion. It may well be that our attempts to set up something like Western parliamentary democracy in New Guinea will meet with the same fate that such attempts have suffered in many other ex-colonial territories - especially in Africa. It may well be that it is just not an appropriate form of government for societies at this level of organization. One thing, I think, is quite certain: that as soon as there is a centralized native administration in power in Port Moresby, coercion will be unstintingly applied to get things done at the local level.

The last thing I wish to do is to criticize the field officers in New Guinea. I have nothing but admiration for them, and for what they have been doing over the years in places like Chimbu. They have been continually striving to

achieve miracles on a shoestring, and if they do not receive from the indigenes the appreciation that their efforts deserve, this is because the indigenes see only the poor results deriving from totally inadequate resources, and not the tremendous efforts put in by the individual field officers.

Clements: Although the nutritional problems of the Territory are probably not of great magnitude, or necessarily will they effect rate of population growth, they do present problems to people working in the field, who are perhaps looking to this symposium for some guidance. The point has been made that nutrition and nutritional problems cannot be seen in isolation but must be viewed in the total social and economic perspective. The foods available to a people belong to their value system. I listened very intensively to see what information could be obtained from the other disciplines that might help to place foods and food problems in the current value system of the Chimbu people. The health and medical people should not try to do this alone. They need help from other disciplines. In any community there are three kinds of people, those who know the answers to current problems and don't need much help (these people come to the public meetings and support baby health clinics and so on); secondly those who don't know they don't know, and who are willing to come along and have some help and finally, those who don't want to know. In an adult education programme you have to work with the first and second groups. In order to work with any group you must know where your subject fits into the total value system. I wonder whether the anthropologists have given thought how they can help the health workers and whether the health people have given sufficient thought as to how the anthropologists can help them. In particular, how the health workers can influence the adults because this is a phase of adult education. If you want mothers to grow peanuts and to give their babies peanut butter then this is an educational programme. Would anyone on the panel comment on how they see the health workers and the anthropologists combining on a programme of adult education.

Brown: This is the first time I have been asked to help anybody on any programme whatever. I would be happy to help but I don't think this is quite the situation here. As far as the Chimbu and his nutritional problems are concerned, it took the nutritional programme to inform the Chimbu people

that there was anything wrong with their infant feeding practices. I think it has been clear from the later papers in the symposium that a lot of Chimbus are not yet convinced that there is anything wrong with the normal feeding of children. The awareness that something can be done with the obviously malnourished infant has however been developing.

Tuza: This morning Dr. Brown inferred that with peanut butter we cannot solve the malnutrition problem in Chimbu infants. She is absolutely right, but we, the field officers, have a problem with sick people. We see some successes with peanut butter. It is a useful aid in solving the problem.

Unknown: I am a chemical engineer and have been concerned with the development of local industries in the underdeveloped countries of the Middle East. The development of local industries is a very effective method of raising the standard of living in the underdeveloped areas. Between the two extremes of a Robinson Crusoe type industry such as the peanut butter project, and the establishment of an oil well, there are many possibilities. The problem is to utilize the local skills and local materials, whether these be vegetable, mineral or animal. In the Chimbu you have limestone and water power. It might be possible to establish a local industry based on these two assets. Such an industry could stimulate the employment of relatively unskilled people. It would help to give an outlet to the products of the educational programme.

Shand: All the possibilities for local industry such as you have mentioned should be investigated, but from what I know of the raw material situation in the Chimbu area, it seems to me to be better to concentrate developmental capital and resources on agricultural products. If a crop can be found that can be intensively cultivated in the area (and I do not think that all possible avenues have yet been explored) this local agricultural industry should be pushed forward. All types of industry should be investigated, but it seems that agricultural industries offer the best prospects.

Unknown: Do you think an improved nutritional state of the people would lead to an increase in their work capacity and therefore the earning capacity?

Bailey: I do not think there is likely to be any substantial improvement either in work capacity or mental development as a result of improved nutrition. The people are already capable of astounding physical feats.

Dr. Muriel Bell: The point was made at the World Food Congress 1963 that the incidence of kwashiorkor is an important matter in the future development of mental capacity.

Dick: Is the standard of nutrition affecting the work capacity of these people?

Hipsley: Regardless of whether or not the work capacity would be improved by better nutrition, and I believe that this improvement is likely to be slight, the main limitations on work capacity are not matters of physical health and nutrition, but are concerned with attitudes to life.

Chairman: Ever since I was asked to chair the symposium I have frankly been worried about what it means. It begins with peanuts, which would seem to denote an unimportant subject. However it ends up with a discussion of the whole problem of a changing society. The title of the symposium is therefore not inappropriate. Beginning with the peanut solution to the problem of infant malnutrition, I find myself not quite sure whether peanuts is the only approach, or whether soya beans should have a bigger place, or whether there are other crops. I only hope that the very practical approach by Dr. Bailey can be extended to other possible protein supplements. However the interesting thing to me is that the problem of malnutrition gave rise to this symposium. It is a challenging situation to anyone looking at the slides we saw of malnourished infants. Yet we are assured that curing it might not make very much difference to the standard of living or to the rate of population growth. Some of the speakers suggested, and in fact it almost suggests itself, that too much emphasis is being given to the problem of malnutrition. However I would like to ask 'What do we mean by priorities'. It has become very clear that we are dealing with a people in transition. There is change in the political structure, accompanied by some disintegration of existing organization; and quite clearly bewilderment and disappointed expectations are associated with economic changes. The new economy was not fully understood by the Chimbu people. Nevertheless money and

progress seem to go together. Progress had not been as rapid as had been expected by the people themselves. Who could expect the Chimbu people to understand the International Coffee Agreement and the world market for coffee. But behind all this problem of transition is a recognition that there are a great many things to be done, and that education is a fundamental investment, whatever the rest of the programme. This education however turns out to be often useless without some other changes going on concurrently. It will be one of the great tragedies of Papua and New Guinea if we find that people get into grade 6 or 7 or whatever it may be, and that there are no opportunities to employ their education. This again points to the need for insuring that the employment opportunities do match the education programme.

Administration comes into the picture everywhere. Administration whether it comes under the old colonial regime, or with the new political power carries a heavy responsibility. As I listened to Mr. Kaad I detected a slightly defensive note in his remarks. This was quite unnecessary, because he put the problem faced by the Administration very well, but not as forcibly as he could have put it. He made a plea for recognition that coordination must be a reality. He made the point that you need finance. I suggest to him that often he may have enough finance, but not the real resources to go with it. It is no good allocating finance to education if you have not the teachers to employ. It may be possible to get finance for a university but you have to have teachers to staff it. Whilst the question of priorities is extremely important, the supply of real resources is no less important.

I come back to remind myself that this notion of co-ordination of effort, of recognising that the society is in transition, started with an essay on malnutrition and peanuts, and that in the course of the discussion protein and peanuts got lost. But I return to it because health happens to be an operative factor as well as a resultant, and thus is one of the contributing factors to progress in the Territory. I have to bow to medical opinion but I am not at all sure that the state of health is not so irrelevant to economic well-being as has been suggested. Even if it were not directly relevant, I am sure it is relevant to the state of mind of people who are expected to jump right into nationhood. I rather expect that the success or otherwise of the local medical officer will be a greater factor in

the educational field than we are led to believe. I do not see how the local health authority, from the medical orderlies to the regional medical officer, can be indifferent to the cases of malnutrition seen in the area. It is not reasonable to suggest that the health programme can be stood aside for a time. It may be given a lower priority but let us be clear what that means. It means that the health programme will get less of any additional money, perhaps a slight reduction in the budget so that something else can be slightly built up. I conclude with the suggestion that the idea implicit in the title of this programme turns out to be a problem that cannot be dealt with except as part of a total co-ordinated programme that attempts to recognise the forces of change. We must see health as part of the total programme from Port Moresby to the Chimbu - and indeed from Canberra to Port Moresby. On your behalf I would like to thank all the contributors including those who spoke from the floor.