SOUTH PACIFIC COMMISSION

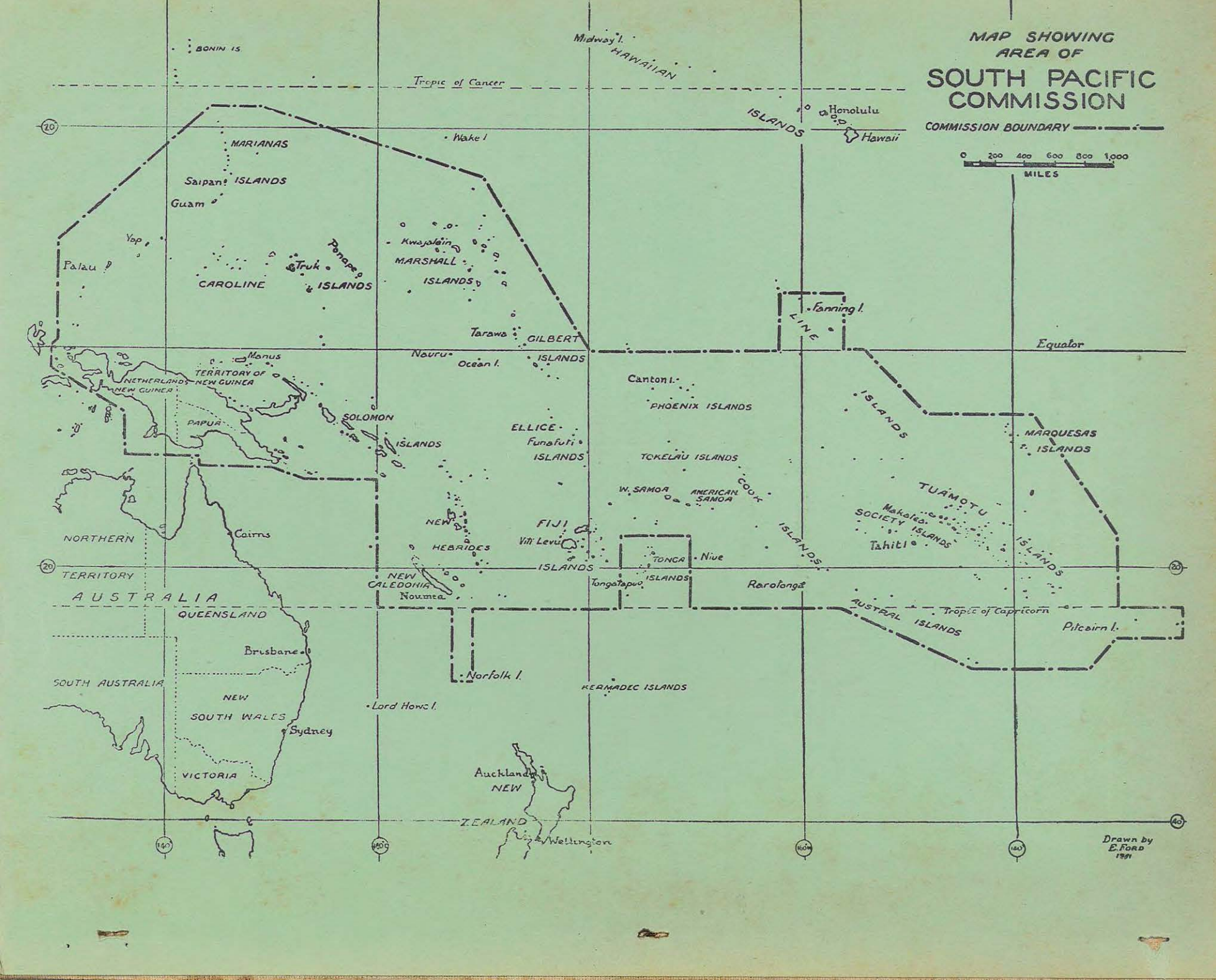
Bibliography of the Nutritional Aspects of the Coconut

Compiled by

F. E. PETERS
Biochemist

Technical Paper No. 58
April 1954

PRICE 2/- STERLING


MAP SHOWING AREA OF
SOUTH PACIFIC COMMISSION
COMMISSION BOUNDARY
0 200 400 600 800 1,000
MILES
BONIN IS.
Midway I.
HAWAIIAN ISLANDS
Honolulu
Hawaii
Tropic of Cancer
Wake I
MARIANAS
Saipan
ISLANDS
Guam
Yap
Palau
CAROLINE ISLANDS
Truk
Ponape
Kwajalein
MARSHALL ISLANDS
Fanning I.
LINE ISLANDS
Tarawa
GILBERT ISLANDS
Equator
Manus
Nauru
Ocean I.
TERRITORY OF NEW GUINEA
NETHERLANDS NEW GUINEA
PAPUA
SOLOMON ISLANDS
Canton I.
PHOENIX ISLANDS
ELLICE ISLANDS
Funafuti
TOKELAU ISLANDS
MARQUESAS ISLANDS
W. SAMOA
AMERICAN SAMOA
COOK ISLANDS
TUAMOTU ISLANDS
Makatea
SOCIETY ISLANDS
Tahiti
NORTHERN TERRITORY
Cairns
NEW HEBRIDES
FIJI
Viti Levu
TONGA ISLANDS
Niue
Tongatapu
Rarotonga
NEW CALEDONIA
Noumea
AUSTRALIA
QUEENSLAND
Brisbane
Tropic of Capricorn
AUSTRAL ISLANDS
Pitcairn I.
SOUTH AUSTRALIA
NEW SOUTH WALES
Sydney
Norfolk I.
KERMADEC ISLANDS
Lord Howe I.
VICTORIA
Auckland
NEW ZEALAND
Wellington
Drawn by E. Ford 1951

South Pacific Commission
Technical Paper No. 58

BIBLIOGRAPHY OF THE NUTRITIONAL ASPECTS OF THE COCONUT

compiled by

F. E. PETERS

Biochemist

South Pacific Commission
Noumea, New Caledonia

April, 1954

C O N T E N T S

Page

Bibliography of the Nutritional Aspects of the Coconut 1

General 1

Endosperm 4

Water 12

Enzymes 18

Vitamins 18

Oil 21

Miscellaneous 32

* * * * * *

PREFACE

In the research conducted by the South Pacific Commission on the improvement of the diet and nutritional status of the peoples of the South Pacific, the fruit of the coconut palm receives particular attention. This is a food widely used in almost all the territories; at the various stages of its development and in various preparations, the coconut is included in the daily diet of the inhabitants.

The chemical composition of the coconut has been studied before and the various tables published on the composition of foods give the information which has been assembled. However, if we try to go any further with the estimation of the nutritive value of this food, we note that our knowledge is still relatively incomplete; the fats only have been carefully studied, mainly with a view to their use commercially. Again, the study of the proteins has not gone very far; some determinations of the constituent amino-acids have been made on press cakes for cattle feed.

Certain new processes, still under study, for extracting oil from the coconut will also enable us to obtain simply the protein fraction which might be used in human diet. The South Pacific Commission has concentrated on the study of the amino-acids content and biological value of this protein fraction.

It was, however, essential to undertake an accurate study of existing documentation on the food value of the coconut. Mr. F.E. Peters, the Commission biochemist, presented in June, 1951 and January, 1952 (Document RC.3/4 and the Commission's"Quarterly Bulletin" of January, 1952) the results of a preliminary survey of the subject.

The bibliography now published completes the initial work; it finalizes the present position and will serve as a basis for future research and publications.

Dr. E. Massal

Executive Officer for Health
South Pacific Commission

Noumea
January, 1954.

BIBLIOGRAPHY OF THE NUTRITIONAL ASPECTS OF THE COCONUT

It has been attempted to make this bibliography as complete as possible, and to cover all the literature available up to 1st January, 1953. However, it is realized that there are many papers that have not been included, and the compiler would appreciate any information on such references. Papers dealing with the economics of copra production, oil manufacture and with diseases of the coconut palm etc. have not been included as these fall outside the intended scope of this bibliography.

In all cases "coconut water" is taken as being the free fluid present in the nut, whilst "coconut milk" refers to the emulsion obtained when fresh coconut kernel is grated with water.

The fatty acids of coconut oil have been abbreviated to C followed by the number of carbon atoms present, e.g. C_6 = hexanoic acid, C_{18} = stearic acid, etc.

Throughout the abbreviations for journals recommended by the World List of Scientific Periodicals, 1900-1950, 3rd Edition, (Butterworths Scientific Publications, London, 1950) have been used. Where the reference has not been actually seen, the source of the information is given in brackets at the end of the entry.

G E N E R A L

1. ALZINA, F.I. "On the palms which are called cocos and their great usefulness".
   Philipp. Agric., (1931) 20, 435-446.
   A general article on the place of the coconut in the Filipino life.

2. BALAKRISHNAMURTHI, T.S. "Reply to an enquiry on the food value of coconut".
   Ceylon Cocon. Quart., (1951) 2, 113-114.
   The flour obtained by grinding the residue left after the extraction of oil from desiccated coconut contains 5.7% water, 7.2% fat, 20.4% protein, 5.4% ash, 9.2% fibre. Other general information is given.

3. BONDAR, G. "O coquero (Cocos nucifera L.) no Brasil".
   Bol. Inst. Fom. econ., Bahia, (1939) 7, 1-100.
   (Biol. Abstr., (1941) 15, 5088.)

4. BONDAR, G. "Products of the coconut palm". Rev. aliment., Rio de J., (1940) 4, No. 34 5-9. A review. (Chem. Abstr., (1941) 35, 219[8]).

5. CHILD, R. "The food value of the coconut". N. Guinea agric. Gaz., (1940) 6, 33-36. A general article summarizing the amounts of the various metabolites.

6. COLLET, O.J.A. "La Noix de Coco", (Paris and Brussels (1913). pp. 176.) A general treatise on the coconut. (Exp. Sta. Rec., (1915) 32, 238.)

7. COPELAND, E.B. "The coconut". (London, (1931) 3rd Ed. pp.233). A popular treatise on the coconut with special reference to the Philippine Islands. (Biol. Abstr., (1934) 8, 1640.)

8. DAHLGREN, B.E. "The cocopalm". Field Museum of Natural History, Chicago. Botany Leaflet (1922), No. 2. A general popular article on the coconut.

9. EATON, B.J. "Copra and Coconut products". Agric. Bull. F.M.S., (1918) 6, 569-592. A review of the Philippines literature up to 1918. Also discusses generally coconut oil extraction from copra and fresh coconuts.

10. GALVEZ, N., MORENO, R., LAVA, V.G. "Chemical Studies on Coconut Products. 11-Utilization of the Coconut". Philipp. Agric., (1928) 17, 163-168. The uses of the various portions and products of the coconut are discussed.

11. GOPALAN, K. "The role of coconut in the country's food economy". Indian Cocon. J., (1951) 4, 171-178. A general survey of the uses of the coconut in the diet in India.

12. HERNANDEZ, B. "Philippine bibliography of the nine major crops of the Philippines (1933)". 157 references listed. (Pradera et al.; Amer. J. Dis. Child., (1942) 64, 977.)

13. HUNGER, F.W.T. "Cocos nucifera. Handboek voor de Kennis van den Cocospalm in Nederlandsch-Indie. (Cocos nucifera. Handbook of information on the coconut palm in the N.E.I.)" pp. 578, Amsterdam (1920) 2nd Ed.
A general treatise on history, botany, geographical distribution, culture and utilization of the coconut.
(Exp. Sta. Rec., (1922) 47, 642.)

14. JARAMILLO, R. "El cocotero. (The coconut)."
Universidad de Antioquia, (1946) 19, (78/79), 197-215.
A review of coconut palms in South America.
(Biol. Abstr., (1947) 21, 12459.)

15. LACERDA, A. "Physical and Chemical constants of some Brazilian foods".
Rev. aliment. Rio de J., (1945) 9, No. 4, 55-7.
Analyses of a large number of foods, including the coconut is given.
(Chem. Abstr., (1946) 40, 1609[7].)

16. LEUBASCHER, C. "The processing of copra, oil palm products and ground nuts".
Bull. imp. Inst., (1948) 46, 4-45.
A general survey of the world economics, methods of production and uses of copra and coconut oil.

17. McCARTHY, F.D. "The coconut palm and its uses in Oceania".
Aust. Mus. Mag., (1942-5) 8, 224-8.
A general article on the place of the coconut in the culture and life of Oceania.

18. MILLER, C.D. "Food values of breadfruit, taro leaves, coconut and sugar cane".
Bull. Bishop Mus., (1929) 64.
The composition of the various edible forms of coconut are given as:

	Water	Protein NX6.25	Fat	Carbohydrate (by diff.)	Ash	Ca.	P.
Coconut Water	94.82	0.23	0.306	3.68	0.64	0.03	0.022
Coconut Milk	52.0	4.02	27.0	18.89	1.08	0.01	0.15
Mature Kernel	14.1	5.7	50.6	27.9	1.7	0.024	0.074
Mature Water	92.7	0.4	1.5	4.6	0.8	0.02	0.01
Green Coconut							
Firm Pulp	82.27	0.7	2.67	2.66	0.566		
Soft Pulp	92.8	0.725	1.02	2.98	0.715		

Coconut is a poor source of Vitamins A and C.

19. MILLER, C.D. and BAZORE, K. "Fruits of Hawaii".
Bull. Hawaii agric. Exp. Sta., (1945) No. 96.
A description, general nutritive value and methods of use of Hawaiian fruits, including coconut is given.

20. MOORE, O.K. "The coconut palm - mankind's greatest provider in the tropics".
Econ. Bot., (1948) 2, 119-144.
This is a good general article on the uses of all parts of the coconut palm.

21. PRUDHOMME, E. "Le Cocotier". (Paris, (1906). pp. 471).
A general survey of the coconut up till 1906.
(Exp. Sta. Rec., (1910) 22, 145.)

22. VISTA, y ISLES, T. "Chemical changes in the ripening coconut".
Philipp. Agric., (1915) 4, 109-115.
A general analysis of changes in colour, size, weight and chemical composition with age is given.

E N D O S P E R M

23. ADRIANO, F.T. "The proximate chemical analysis of Philippine foods and feeding stuffs II".
Philipp. Agric., (1929) 18, 119-126.
A general analysis of a wide range of Filipino foodstuffs is given. The composition of coconut is given as:

	Coconut haustorium %	Coconut meat (shredded) %
water	15.23	44.96
ash	9.39	1.06
fat	15.68	32.92
protein	10.69	1.22
carbohydrates	38.42	2.27
fibre	10.59	17.57
calories /100 g.	347	320

24. ADRIANO, F.T. & MANAHAN, M. "The nutritive value of green, ripe and sport coconuts, (buko, niyog and makapuno)".
Philipp. Agric., (1931) 20, 195-198.
A very comprehensive analysis is given which is tabulated on page 6.

25. BERTRAND, G. & BENZON, B. "The zinc content of the chief vegetable foods".
Bull. Soc. sci. Hyg. aliment Paris., (1928) 16, 457-463.
The zinc content of fresh coconut endosperm is 10 mg./Kg.; of dry endosperm is 17.2 mg./Kg., and of ash is 1053 mg./Kg.
(Chem. Abstr. (1929) 23, 2504^{8}).

26. BARBORIAK, J. & SCHURCH, A. "Berioht über einen verfleichenden milschviehfutterrungsversuch mit Kokosectractionschrot und Kokopresskucken. (Report of a comparative cattle fodder trial with coconut extraction meal and coconut press cake)".
Landw. Jb. Schweiz. (1950) 64, 863-86.
There was no apparent variation between the extraction meal and press cake, on milk production, butter fat content etc.

27. BROCK, F.D. & HOLLEMAN, M.P. "Commercial feeding stuffs".
Bull. Tex. Agric. Exp. Sta., (1948) 703.
An analysis of coconut meal is given as crude protein 19.39%, crude fat 11.78%, crude fibre 10.94%, nitrogen free extract 8.28%, crude ash 6.30%.

28. CARAY, E.M. "The chemical composition of copra meal, with special reference to the nature of its carbohydrates." (with bibliography).
Philipp. Agric., (1921) 10, 55-68.
The percentage composition of carbohydrates in copra meal was found to be: sucrose 32.82%, raffinose 5.54%, galactose 5.54%, glucose 2.72%, fructose 2.75%, pentoses 5.49%, cellulose 35.63%, pentosans 5.09%, starch 1.98%, dextrin 1.29% and galactan 1.10%.

29. CARAY, E.M. "Isolation and identification of some of the sugars in copra meal and coconut water".
Philipp. Agric., (1934) 13, 229-253.
Glucose, fructose, sucrose, galactose and raffinose were isolated and identified from copra meal, and sucrose, fructose and glucose were isolated from coconut water.

30. CHANDRASENA, J.P.C. "The chemistry of the products of Cocos nucifera 1". Biochem. J., (1930) 24, 1493-1495.
The percentage of water in the kernel diminishes with age, whilst the iodine and acid values decrease also with maturity.

31. CHILD, R. "Analysis of some samples of Maldive copra". Trop. Agriculturist, (Ceylon), (1936) 384-385.
Some samples of Maldive copra gave on analysis: water 5.9%, oil 64.1%, free fatty acid in oil 0.28%, iodine value of oil 7.3, refractive index of oil at 40° : 1.4490.

32. CHILD, R. "Coconut flour". J. Coconut Industr., (1940) 4, 117.
A typical sample of flour contains 20.4% protein, 5.4% ash, 9.2% fibre. It makes satisfactory cakes when mixed with 50% wheat flour. Because of its readiness to absorb moisture and become liable to mould attack, it must be marketed in moisture-proof containers.

33. DEKKER, J. "Composition of East Indian feeds". Teysmannia, (1910) 21, 103-105.
An analysis of coconut cake and foliage is given.
(Exp. Sta. Rec., (1911) 24, 573.)

34. FRENCH, M.H. "Nutritive value of oil cakes and cotton seeds". Dept. Vet. Sci. & Animal Husb., Ann. Rep., Tanganyika Territory, (1933), 49-54.
The composition of locally produced coconut cake was given as: crude protein 21.72%, true protein 19.63%, amides 2.09%, ether extractable 14.98%, nitrogen free extract 39.2%, crude fibre 15.21%, ash 8.8%, SiO_2 3.23%, CaO 0.499%, P_2O_5 1.53%.
The starch equivalent was given as 93.94 gms/100 gms. of dry cake.

35. HORN, M.J.
JONES, D.B. &
BLUM, A.E. "Methods for microbiological and chemical determinations of essential amino acids in proteins and foods". Misc. Publ. U.S. Dep. Agric., (1950) No. 696.
The essential amino acid content of coconut globulin is given as: arginine 16.73, histidine 1.52, iso leucine 4.43, leucine 7.18, lysine 4.37, methionine 2.02, phenylalanine 5.10, threonine 4.06, tryptophan 0.66, valine 5.92%. The total nitrogen value was 17.42.

36. ITO, H.

"Chemical studies on protein, carbohydrates and oil of copra. 1."
J. Agric. Chem. Soc., Japan. (1944) 20, 97.
An analysis of the copra gave 70% oil, 10% carbohydrates, 8% proteins. The meal after oil extraction contained 28% carbohydrates, 25% protein. Of the total nitrogen 23-28% was water soluble, 10-13% soluble in sodium chloride solution, 10% soluble in 70% ethyl alcohol, 40-47" soluble in 0.2% sodium hydroxide.
(Chem. Abstr., (1949) 43, 881e.)

37. JANSEN, B.C.P.

"On consumption of coconut press cake as protein containing food for humans". Dutch and English.
Meded. geneesk. Lab. Weltevr (Java) (1920) 1-21 3e, Ser. A.
It is suggested that coconut press cake could be used in human nutrition. The results are, however, inconclusive.

38. JOHNS, C.O.
FINKS, A.J. &
GERSDORFF, C.E.F.

"Globulin of the coconut, Cocos nucifera. 1 Preparation of coconut globulin. Distribution of the basic nitrogen in coconut globulin".
J. Biol. Chem., (1919) 37, 149-153.
The extraction of coconut globulin is described. The following amino acids were found: 1.44% cystine, 15.92% arginine, 2.42% histidine, 5.8% lysine, trace of tryptophan.

39. JOHNS, C.O.
FINKS, A.J. &
PAUL, M.S.

"Studies in nutrition. 1 The nutritive value of coconut globulin and coconut press cake".
J. Biol. Chem., (1919) 37, 497-502.
The coconut globulin was claimed to produce a normal growth response in rats when fed as the sole source of protein, whilst coconut press cake produces an almost normal growth response.

40. JOHNS, C.O. &
JONES, D.B.

"Some amino acids from the globulin of coconut as determined by the butyl alcohol extraction method of Dakin".
J. Biol. Chem., (1920) 44, 283-290.
The following amino acids were found by the Dakin butyl alcohol extraction method: 2.6% alanine, 5.54% proline, 19.07 glutamic acid, 5.12% aspartic acid, 1.76% serine.

41. JONES, D.B. & JOHNS, C.O.

"Hydrolysis of the globulin of the coconut, Cocos nucifera".
J. Biol. Chem., (1920) 44, 291-301.
An analysis of the hydrolysed coconut globulin gave: trace of clycine, 4.11% alanine, 3.57% valine 5.96% leucine, 5.54% proline, 2.05% phenyl-alanine, 5.12% aspartic acid, 19.07% glutamic acid, 1.76% serine, 3.18% tyrosine, 1.44% cystine, 15.92% arginine, 2.42% histidine, 5.8% lysine, trace of tryptophan, 1.57% ammonia.

42. JONES, D.B. GERSDORFF, C.E.F. & MOELLER, O.

"The tryptophan and cysteine content of various proteins".
J. Biol. Chem., (1925) 62, 183-195.
The tryptophan content of coconut globulin was determined colourimetrically as 1.25%, the cysteine content was 1.54%.

43. KAHREN, L.

"The detection of antioxidant activity of oil press cakes from the absorption spectra of vitamin A".
Oléagineux, (1948) 3, 387.
The degradation of vitamin A measured spectrometrically, is inversely proportional to the antioxidant activity of a given oil press cake. When 100,000 I.U. vitamin A is stored with 100 gms. of copra press cake for 10 hours complete destruction of the vitamin A occurs indicating a lack of antioxidant activity.
(Chem. Abstr., (1949) 43, 424 g.)

44. KUPPUSWAMY, S. GIRI, K.V. & SUBRAHMANYAN, V.

"Oilseed cakes as supplements to South Indian rice diets".
Sci. and Cult., (1946) 12, 249-250.
Coconut cake was found to be a good supplement to the poor South Indian rice diets, whilst peanut cake had very little value.

45. MAYNARD, L.A. & FRONDA, F.M.

"The relative growth promoting value of the protein of coconut oil meal, and of combinations of it with proteins from various other feeding stuffs".
Mem. Cornell agric. Exp. Sta., (1921) 50, 621.
The coconut protein was shown to be of a higher quality than corn meal.

46. MICHEL, R. & SCHILLER, J.

"Colourimetric determination of tryptophan". Bull. Soc. Chim. Biol., (1945) 27, 456-458. Copra is stated to contain 3.07% nitrogen, and the protein to contain 1.61% tryptophan. (Chem. Abstr. 1946) 40, 49804).

47. MITCHELL, H.H. HAMILTON, T.S. & BEADLES, J.R.

"The importance of commercial processing for the protein value of food products. 1. Soy bean, coconut and sunflower seed". J. Nutr., (1945) 29, 13-25. Coconut meal produced by the solvent extraction method where the temperature did not exceed 75°C. showed 20.7% protein which had a digestibility of 86.1% and a biological value of 71. Drastic heat treatments as may result in the expeller extraction method may reduce the biological value to 58.

48. MITCHELL, H.H. & VILLEGAS, V.J.

"The nutritive value of the proteins of coconut meal, soy beans, rice bran and corn". J. Dairy Sci., (1923) 6, 222-236. Using rat feeding experiments coconut meal was found to possess 18.8% digestible protein, having a biological value of 59.

49. NICHOLLS, L. DRUMMOND, J.C.

"Nutritive value of coconut". Nature, (1945) 155, 392. Two notes pointing out the disadvantages of coconut as an infant food. It is stated that the kernel contains 35-45% oil, 15% carbohydrates, less than 5% protein of a low biological value for infants.

50. ROCHE, J. & BAUDOIN, N.

"Sur la composition en acides aminés des protéines du tourteau de coprah et sur les variations de leur teneur en méthionine. (On the amino acid composition of proteins in copra press cake and the variations of their methionine content)". Oléagineux, (1951) 6, 11-14. The essential amino acid content of copra press cake was determined as: alanine 2.9%, arginine 7.0%, cystine 1.8%, glycine 5.9%, histidine 2.7%, lucine 11.3%, lycine 4.8%, methionine 1.8%, phenylalinine 5.2%, tryptophan 1.6%, valine 2.4%. Depending on the method of preparation the methionine content was shown to vary between 0.4% and 1.9%.

51. SANTOS y ALVAREZ, F.O. "A biochemical study of copra meal". Philipp. J. Sci., (1920) 16, 181-189. The composition of the meal is given as: Water 11.3%, oil 12.2%, crude protein 20.1%, ash 5.5%, crude fibre 13.2%, carbohydrates 37.0%. A partition of the nitrogen is also given.

52. SADASIVAN, V. "The supplementary nutritive value of coconut cake". Proc. Indian Acad. Sci., (1950) 32, Sec. A 409. Coconut cake when supplemented at a 30% level in a poor rice or tapioca diet caused a good growth response in rats.

53. SMUTS, D.B. "Plant proteins. 1. A comparative study of the growth-promoting properties of the proteins of peanut meal, sesame meal, copra meal, lucerne meal and cotton-seed meal". Onderstepoort J. Vet. Sci., (1938) 10, 193-205. Using paired feeding on rats it was shown statistically that cotton-seed meal protein was superior to either peanut or coconut proteins.

54. SMUTS, D.B. & MALAN, A.I. "Plant proteins. 11. The biological value of lucerne meal, sesame meal, peanut meal, copra meal, cotton-seed meal, and oat meal". Onderstepoort J. Vet. Sci., (1938) 10, 207-219. Using nitrogen balance studies the biological value of the various meals was shown to be: oat 84, cotton 81, peanut 72, sesame 71, copra 69 and lucerne 60. The true digestibility was found to be: peanut 90, sesame 92, copra 89, cotton 92, lucerne 74.

55. SPYCHALSKI, R. "Determination of the molecular weight of coconut globulin". Roczn. Chem., (1930)10, 630-650. Using a Svedburg ultracentrifuge two fractions having molecular weights of 104,000 and 208,000 were separated from coconut globulin. (Chem. Abstr., (1931) 25, 9764).

56. SULIT, V. "Studies on the toxicity of copra meal. 1." Philipp. Agric., (1926) 14, 511-522. Copra meal fed at 75-85% level to guinea pigs proved fatal.

57. SULIT, V.

"Studies on the toxicity of copra meal. 11", Philipp. Agric., (1926) 14, 595-607.
Copra meal fed at a 75-85% level in an otherwise complete diet in rats led to stunted growth, emaciation, inactivity and weakness. Effect was usually, though not necessarily fatal. The young were born dead.
At a 37% level the meal exhibited growth-promoting properties.

58. UMEA, I. & HATANO, M.

"Chemical constitution of copra meals, 1: The carbohydrates".
J. Agric. Chem. Soc., Japan, (1949) 23, 85.
An analysis of various copra meals gave: 8.7% water, 26.44% crude protein, 15.95% pure protein, 13.35% lipides, 3.82% ash, 9.52% crude fibre, 37.17% nitrogen free extract, 0.46% glactan, 21.08% soluble carbohydrates, 4.97% pentosans, 1.35% reducing sugars.

59. VASCONCELLOS, J. de C.

"Copra of Mozambique".
Ann. Inst. Sup. Agron., Lisboa, (1934) 6, 63-73.
The analysis of seven samples gave the range of figures: less than 6% water, 66.06-85% oil, 1.74-3.18% ash, 5.69-7.34% crude protein, 8.02-10.03% cellulose, 8.73-12.4% nitrogen free extract.
(Chem. Abstr., (1936) 30, 1250^{3}).

W A T E R

60. BEJARANO, J.

"Treatment of dyspepsia in the new born with coconut milk".
Rev. Fac. Med., Bogota. (1933) 2.
Coconut gives good results in infant gastric disorders when substituted for cow's milk. This is said to be due to a change in the intestinal flora.
(Chem. Abstr., (1935) 29, 3731^{7}).

61. BLAUVELT, K.

"The use of non-cooked, non-sterilized coconut milk as an additional nutrient substance in culture media".
J. Lab. clin. Med., (1939) 24, 420-423.
The addition of 10-25% of coconut water gave a superior medium for the growth of Staph. aures, B. fecalis and Cl. welchii.

62. BRITO, J.C. & DREISS, G.

"Ensayos con el agua de coco por via intravenosa como medio terapeutico. (Trials with intravenous coconut water in medical therapeutics)."
Arch. Hosp. Rosales, (1943) 24, 420-423.
Intravenous injection of coconut water caused a diuretic response in 6 cases of nephritis and in 2 cases of atrophic cirrhosis with ascites.
(Biol. Abstr. (1944) 18, 19, 371.

63. BRITO, J.C. & DREISS, G.

"El uso de aguo de coco intravenosa como elemento terapeutico. (The use of intravenous coconut water in elementary therapeutics)".
Arch. Hosp. Rosales, (1943) 35, (87), 66-68.
Intravenous injections of coconut water cause diuresis without side effects. An analysis of coconut water is appended.
(Biol. Abstr., (1944) 18, 6423).

64. CAPLIN, S.M. & STEWARD, F.C.

"Effect of coconut milk on the growth of explants from carrot root".
Science, (1948) 108, 655-657.
A 15-20% addition of coconut water added to White's nutrient solution causes an optimum growth of carrot root explants, about 20 times greater than that shown by the addition of indole acetic acid.

65. CHANDUSENA, J.P.C.

"The chemistry of the products of Cocos nucifera. 11".
Biochem. J., (1933) 27, 3-4.
The temperature of the water immediately after picking is 1^{o} below the air temperature. The specific gravity increases with age. The pH ranges from 4.6-5.6.

66. CHILD, R. & NATHANAEL, W.R.N.

"Changes in the sugar composition of coconut water during maturation and germination".
J. Sci. Fd. Agric., (1950) 1, 326-329.
The concentration of sugars during maturation increases from about 1.5% to 5% in the first seven months, thereafter it falls to about 2% at 12-13 months. The concentration of 2% remains constant during germination until the fourth month whereafter it falls. Until the 7th month of maturation the sugars are almost entirely reducing, after which non-reducing sugars appear. The glucose, fructose and

sucrose appear to be the sugars present. Mannitol could not be detected and it is suggested to be caused by bacterial action.

67. CHILD, R. & NATHANAEL, W.R.N. "Utilization of coconut water".
Trop. Agriculturist, (Ceylon), (1947) 103, 85-89.
The mean result of analyses of coconut water are given as: total solids 4.71g., reducing sugars 0.8g., sucrose 1.28g., total sugars 2.08g., ash 0.62g., organic solids not identified 2.01g. per 100 mls.
Means of utilizing the water are discussed.

68. DUHAMET, L. "Action du lait de coco sur la croissance des tissus de Parthenocissus tricuspidata cultivés in vitro. (Aotion of coconut milk on the growth tissues of P. tricuspidata cultivated in vitro)".
C.R. Soc. Biol., (1950) 144, 59-61.
Coconut water has a stronger growth-promoting action on P. tricuspidata than an equivalent concentration of indole acetic acid, as determined by the oat test. The nature of this growth substance is still undetermined.

69. GANGULI, S.K. "Chemical examination of water from Cocos nucifera".
Sci. & Cult., (1936-7) 2, 224-225.
A general analysis of cocohut water at different growth periods is given as:

	pH	NcCl %	Red. Sug. %	Sucrose %	Vit. C. mg/100 ml
Green nut					
Without kernel	4.8	0.28	3.95	0.148	2.5
With soft kernel	4.9	0.25	5.25	0.329	3.71
With semi hard kernel	4.9	0.27	5.26	0.484	3.44
With hard kernel	5.3	0.38	2.24	0.160	2.24

70. GESTEIRA, M. & BAHIA, A. "Coconut milk in nutritional disturbances in infants".
Brazil - med., (1932) 46, 169-192.
Cocenut water was used in infant nutrition disturbances.
(Klein, J.: Arch. Ped., (1933) 50, 205-210).

71. GONZALEZ, B.M.S. "The changes occurring in the ripening coconut". Philipp. Agric., (1914) 3, 25-31.
Three stages of growth were identified:

(a) There is an accumulation of invert sugar and amino acids in the water. Meat is still absent.

(b) Sucrose appears in the water, the specific gravity of which is high.

(c) The oil content of the endosperm rises and the specific gravity of the water falls.

72. GORIS, A. "Influence comparée de l'acide indole acétique et du lait de coco sur les réserves glucidiques des couches de tissu de carotte. (Comparative influence of indole acetic acid and coconut water on the glucosidal reserves of carrot root tissue)".
C.R. Acad. Sci., (1950) 231, 870.
Indole acetic acid has no influence on the glucosidal composition of carrot root tissues. Coconut milk, however, causes a net decrease in the reducing sugars present. The factor present in coconut milk is not an auxin.

73. HICKING, A. "Coconut Milk: Substitute for dextrose in normal saline".
Hospital Corps Quarterly. (Supplement to Nav. med. Bull., Wash.) (1949) 22, No. 3.
A report on the use of intravenous fresh coconut water in cases of severe undernutrition among certain Gilbert Islanders during the Japanese occupation. Favourable results appear to have been obtained, although no quantitative results are presented.

74. MATHEWS, C.G. "Notes on the liquid from ripening coconuts".
Analyst, (1924) 49, 223-224.
The specific gravity was found to be 1.0421 - 1.0555; total solids 9.92-13.06g/100 ml., sucrose 7.09g/100 ml. On warming the water, coagulation sets in at about 43°.

75. MENENDEZ, P. "El coco, medio y balon de cultivo".
Arch. Hosp. Rosales, (1943) 35, (92), 14-32.
The technique and results of inoculation of sterile coconut water are described.
(Biol. Abstr., (1944) 18, 20,027).

76. MOJUMDAR, N.G.

"Intravenous use of green coconut water in pediatric practice".
J. Indian med. Ass., (1951) 20, 211-212.
A preliminary report of the use of coconut water in nutritional oedema. Success was reported in the one case; the oedema disappeared and the weight of the patient dropped from 19 lb. 14¼ to 18 lb. 1½ oz.

77. van OVERBEEK, J.

"Hormonal control of embryo and seedling".
Cold Spr. Harb. Symp. Quant. Biol., (1942) 10, 126-134.
The growth factor of coconut water was obtained by concentrating the water and treating with 80% ethyl alcohol. This purified factor exhibited activity at dilutions of 1:4000.

78. van OVERBEEK, J. CONKLIN, M.E. & BLAKESLEE, A.F.

"Factors in coconut milk essential for growth and development of very young Datura embryos".
Science, (1941) 94, 350-351.
A preliminary report on the use of coconut water in growth media for Datura embryos.

79. van OVERBEEK, J. CONKLIN, M.E. & BLAKESLEE, A.F.

"Cultivation in vitro of small Datura embryos".
Amer. J. Bot., (1942) 29, 472-477.
Three growth factors appear to be present in coconut water:

(a) a thermolabile factor causing growth and differentiation;

(b) a thermostable factor inhibiting root growth (auxin?);

(c) a thermostable factor giving callus-like growth in some cases.

80. PICADO, C.

"El agua de coco como medio de cultivo (Coconut water as a culture medium)".
Bol. Ofic. Sanit., pan-amer., (1942) 21, 960-965.
Arch. Hosp. Rosales, (1943) 35, (92), 33-38.
Natural coconut water has a pH of 5.6 and is a good medium for the growth of plant and animal fungi, yeasts, acid forming bacteria, fruit fly larvae, and orchid seed germination. Alkalonized water may be used for the growth of intestinal bacteria.
(Biol. Abstr., (1945) 17, 20532. (1944) 18, 20030).

81. PINTO, C.B. "Study of coconut milk and its possible employment in therapeutics".
Rev. Soc. Venezol. Quim., (1950) 4, No. 22, 36-45.
Coconut water contains approximately 0.43 g. protein per 100 ml.
(F.A.O. Nutrition Division - personal communication).

82. PLATT, B.S. "Tables of representative values of foods commonly used in tropical countries".
M.R.C. Spec. Rep. Ser., (1945) No. 253.
The values given for coconut are:

(1) for the kernel, water: 43%, calories: 404/100 gms, protein: 4%, fat: 40%, carbohydrate: 7%, calcium 10 mg/100 gms, iron: 2 mg/100 gms, vitamin A: nil, thiamin: 0.11 mg/100 gms, ascorbic acid: 1 mg/100 gms;

(2) for the water, water: 92%, calories: 22/100 gms, protein: 0.5%, fat: nil, carbohydrate: 5%, calcium: 30 mg/100 gms, iron: nil, vitamin A: nil, thiamin: nil, ascorbic acid: 2 mg/100 gms.

83. PRADERA, E.S. FERNANDEZ, E. & CALDERIN, O. "Coconut water - a clinical and experimental study".
Amer. J. Dis. Child., (1942) 64, 977-996.
A good complete survey of the literature up to 1941 and the uses of coconut water in pediatrics. (82 references are given).
The amino acids in coconut water are present as peptones and have the composition: Glutamic acid 9.76-14.50, Arginine 12.75, leucine 1.95-4.18, lysine 1.95-4.57, proline 1.21-4.12, aspartic acid 3.60, tyrosine 2.83-3.0, alanine 2.41, histidine 1.95-2.05, phenylalanine 1.23, serine 0.59-0.91, cystine 0.97-1.17, % of dry protein. The mineral content was given as 29-46 mg Ca, 105-160 mg. CO, 5.5-9.0 mg. P, 134-220 mg. K per 100 ml.
The uses of coconut water in pediatrics are discussed.

84. STEEL, T. "Chemical Notes - IV "Milk" of unripe coconuts".
Proc. Linn. Soc. N.S.W., (1922) 47, 445.
The results of analyses done in 1885 are given as: Sucrose 0.53-0.61%, fructose 4.58-4.82%, protein and fat 0.32-0.86%, water 93.55-93.66%, specific gravity 1.0250-1.0255.

85. van SLYKE, L.L. "Analysis of milk of unripe and ripe coconuts". Amer. Chem. J., (1891) 13, 130-131. The analysis of six nuts is given as: Sucrose, trace, fat 0.1084-0.145%, ash 0.575-0.675%, glucose 3.45-4.58%, water 94.37-96.43%, specific gravity 1.0245-1.0246.

86. TUKEY, H.B. "Plant breeding by incubator methods". Sci. Mon., N.Y., (1944) 58, 321-322. Jimson weed embryos are readily cultured in media containing coconut water.

ENZYMES

87. BRILL, H.C. "The enzymes of some tropical plants". Agric. J. India, (1919) 14, 660-667. This is a very general review article. The presence of lipase in coconut is discussed without any definite conclusions being reached.

88. ROXAS, M.L. "Lipase in the germinating coconut". Philipp. Agric., (1914) 3, 33-39. Lipase is present in the germinating coconut, haustorium with lesser amounts in the water. It works best at a neutral pH and is inhibited by 0.4% cyanide and arsenite.

89. SADAVISAN, V. "Phosphatase in coconuts". Arch. Biochem., (1951) 30, 159-164. Phosphatases were demonstrated in the embryo, kernel and water. The embryo also contains amylase, lipase, protease, invertase, peroxidase, catalase and dehydrogenases. The kernel and water contain peroxidase, catalase and dehydrogenases. The phosphatase has a pH optimum at 5.6. It is inhibited by 10^{-3} fluoride but not by cyanide or iodoacetate.

VITAMINS

90. ANON "Tables of vitamin values of edible Argentine vegetable products". Publicaciones del institute nacionel de la nutricion (Buenos Aires) Publicaciones cientificas C.N.P., (1945) 29, 9-55.

90. (Cont'd.) Coconut is said to contain no vitamin A, 1738 % thiamine, trace of riboflavin, 1038 % niacin, no vitamin C.
(Chem. Abstr., (1946) 40, 5831[3]).

91. AXTMAYER, J.H. "The vitamin B complex of coconut water".
Amer. J. trop. Med., (1932) 12, 323, 326.
Using rat growth experiments, it was concluded that the water from the ripe coconut is a poor source of thiamin, but a relatively good source of riboflavin.

92. BANERJEE, H.N. "Chemical and Physiological investigations on the presence of vitamin C in certain substances in plants".
Trans. Bose Res. Inst., Calcutta, (1934-5) 10, 145-170.
The following observations were recorded.

	pH	Vitamin C in mg %
Juice of coconut palm	44-47	12-30
Green coconut water	4.8-6.0	1.2-2.8
Green coconut kernel		1.6-3.6
Ripe coconut water	5.3-6.2	1.2-2.8
Ripe coconut kernel		2.0-3.6

93. BANERJEE, H.N. "Ascorbic acid content of some plant fluids".
Curr. Sci., (1935-6) 4, 28-29.
The ascorbic acid content of various forms of coconut was found to be:

	pH	Vitamin C in mg %
Green nut - no kernel	4.8-5.0	1.2-1.5
soft kernel	4.9-5.0	1.5-2.9
Ripe nut	5.1-5.4	
Sap of coconut tree (cf. entry No. 92)	4.2-4.7	16.0-30.0

94. BISWAS, H.G. & GHOSH, A.R. "Investigations on vitamin C content of coconut".
Sci. and Cult., (1936) 1, 518-519.
The follicle of the germinating fruit has the highest content of vitamin C. Green nuts are richer than mature nuts.
(Chem. Abstr. (1936) 30, 5673[5]).

95. ENGEL, C. & VRIES, A.M.

"The tocopherol (Vitamin E) content of different foods from the Dutch East Indies".
Z. Vitaminforsch. (1946) 18, 89-91.
The tocopherol content of coconut is given as 0.2 mg% and of cooconut oil as 3.6-5.0 mg%.

96. HERNANDEZ, M.

"The vitamin content of Cuban fruits".
Agronomia, Habana, (1943) 3, 58-59.
The ascorbic acid content of coconut water is given as 0.7-1.6 mg%.
(Chem. Abstr. (1943) 37, 4816[4]).

97. JANSEN, B.C.P.

"Het gehelte aan in vet oplosbare vitaminen in klapparolie. (The ameunt of fat soluble vitamins in coconut oil").
Geneesk.Tijdschr. Ned.-Ind., (1918) 58, 173.
Chem. Weekblad, (1918) 15, 1574.
Meded. Dienst. v. Volksgezondheid, (1918) 7, 78.
Coconut oil contains very little fat soluble vitamins.
(Chem. Abstr. (1920) 14, 2811[4], O.S.R. (1951) News, 3, 262).

98. MILLER, C.D.

"The vitamin values of foods in Hawaii".
Bull. Hawaii agric. Exp. Sta., (1947) No. 6.
For coconut water a vitamin C value of 2 mg% is given whilst immature meat is said to contain 3 mg%. Mature meat contains 0.11 mg% thiamine. The other vitamins are not present or were not determined.

99. MUNSELL, H.E.

"Ascorbic acid content of fruits of Puerto Rico with data on miscellaneous products".
Food Res., (1945) 10, 42-51.
The ascorbic acid content of fresh geen coconut water was given as 1.35 mg/100 ml.
(Range 0.96-1.66 mg/100 ml.)

100. SALMON, W.D. & GOODMAN, J.G.

"Alleviation of vitamin B deficiency in the rat by certain natural fats and synthetic esters".
J. Nutr., (1937) 13, 477-500.
High percentages of fat in vitamin B deficient diets increased the rate of growth and decreased the incidence of beri-beri. Coconut oil was the most effective natural fat tested, and a maximim effectiveness was obtained with octanoic acid (C_8): the effectiveness decreased on lengthening or shortening the carbon chain.

101. VANDENBELT, J.M. "Nutritive value of coconut".
Nature, (1945) 156, 174-175.
Using microbiological methods the B vitamin content of coconut water was found to be: nicotinic acid 64.8%, biotin 2%, pantothenic acid 52%, riboflavin less than 1%, folic acid 0.3%. Thiamine and pyridoxine appear to be absent.

O I L

102. AHMED, B. & SAREEN, R.N. "Relative Digestibility of common edible fats by Ricinus lipase".
J. Sci. industr. Res., (1946) 4, 710-712.
Coconut oil is readily digested by ricinus lipase and has a higher digestibility than mustard oil, olive oil, buffalo ghee or lard.

103. ALLAN, J. & MOORE, C.W. "An examination of coconut oils together with a note on the oils from some other members of the Palmae".
J. Soc. Chem. Ind., London, (1925) 44, 61T-63T.
A comparison is made between the saponification value, iodine value and percentage of free fatty acid of the oil from the kernel, oil from the brown teste (parings) and oil from the whole meat. Samples were obtained from all over the world.

	Kernel Oil	Teste Oil	Whole Oil
Sap value	213.4-219.3	232.5-253.5	214.2-221.0
Iodine value	5.7-9.3	21.5- 59.7	7.1- 10.5
% F.F. Acids	0.1-0.5	0.2- 12.7	

The ratio of parings to kernel was 1:10-1:25.

104. ARMSTRONG, E.F. ALLAN, J. MOORE, C.W. "The fatty acid constituents of some natural fats. 1 The oils from the coconut".
J. Soc. Chem. Ind., London, (1925) 44, 63T-68T.
The technique of fatty acid analysis by the fractional distillation of the methyl esters is discussed.

104 (Contd.) The % composition of "kernel" and "parings" oil is given as:

	C8	C10	C12	C14	C16	C18	Oleic	Linoleic
Kernel	9.5	4.5	51.0	18.5	7.5	3.0	5.0	1.0
Parings	2.0	2.0	28.0	22.0	12.0	1.0	23.0	10.0

105. BANZON, J. "Studies on coconut oil. 1 Pyrolysis". Philipp. Agric., (1937) 25, 817-832. Distillation of coconut oil with various catalysts yielded varying amounts of an unsaponifiable substance.

106. BANZON, J. "Studies on coconut oil. 11 A method for conversion into solids". Philipp. Agric., (1937) 26, 399-402. When coconut oil is heated with an iron or iron oxide catalyst at 300°C. a white crystalline substance (M.P. 55°) is formed. The composition was not known. The substance was soluble in fat solvents.

107. BASU, K.P. & NATH, H.P. "The digestibility of certain vegetable oils and fats determined by metabolic experiments on human beings". Indian J. med. Res., (1946) 34, 13-17. The coefficient of digestibility of mustard, coconut, sesame and peanut oils was found to exceed 94% when tested on four subjects.

108. BASU, K.P. & NATH, H.P. "The rate of absorption of different fats and oils". Indian J. Med. Res., (1946) 34, 19-25. Coconut oil appears to be more slowly absorbed than mustard, olive, peanut, sesame oils or butter fat.

109. BASU, K.P. & NATH, H.P. "The effect of different fats on the calcium utilization in human beings". Indian J. med. Res., (1946) 34, 27-31. Mustard, sesame, ground nut oils or butter fat aided the absorption of calcium and phosphorus in four persons to different degrees. Coconut oil gave a negative balance, with a higher urinary and fecal excretion.

110. BERTRAM, S.H.

"Heat of combustion of fatty acids and oils". Chem. pharm. Tech. (Dordrecht), (1946) 1, 101-102.
The heat of combustion as determined in the bomb calorimeter was found to be related to the iodine value and saponification value by the equation: H.C. = 11,380 - I.No. - 9.15 Sap. val. ± 35 cal/g.
Using this method cocoanut oil gave a value of 9029 cals/g (9.029 kilocalories/g).
(Chem. Abstr., (1946) 40, 6848[4]).

111. BILGER, L.N. & WESTGATE, M.

"Sterols of tropical oils".
Bull. Hawaii agric. Exp. Sta. (Annual Report), (1937) 54-55.
Sterols were obtained from the oils avocado, kukui nut, china wood, local and Indian chaulmoogra and coconut.
Coconut oil contained 0.25% unsaponifiable matter, 25.13% of which was precipitated by digitonin. Sterol content of the oil was 0.09%. Constants of the sterol are M.P. 121°.5-123°.8 $[\alpha]_D^{25}$ - 21.21, molecular weight 394.

112. BIROSEL, D.M., MILLAR, F., NESSIA, E. & TAGORDA, F.

"Properties of coconut oil prepared directly from fresh coconut milk".
Natural appl. Sci. Bull., (1939) 7, 39-49.
The oil was extracted by the "Lava" method (cf.) and possessed the following physical and chemical properties:- Saponification No. 255.8, iodine value 8.3, acid value 2.37, acetyl value 11.25%, Reichart-Meissl No.7.18, Polenske No.15.39, M.P. 26°, specific gravity at 40° 0.9129, refractive index at 40° 1,4455, surface tension at 40° 24.22 dynes/cm., viscosity at 40° 256.4 millipoises, optical rotation nil, % composition of fatty acids was: C_6 0.38, C_8 6.54, C_{10} 8.95, C_{12} 55.06, C_{14} 16.89, C_{16} 7.36, C_{18} nil, oleic 4.01, linoleic 0.81.

113. CALDWELL, K.S. & HURTLEY, W.H.

"The distillation of butter fat, coconut oil and their fatty acids".
Proc. chem. Soc. London, (1909) 25, 73.
Using a distillation under reduced pressure it was claimed that coconut oil contained at least 60% of C_{12}
(Analyst, (1909) 34, 274-275).

114. CARANGAL, A.R. & BANZON, J.
"Studies on the solvent extraction of coconut oil with ethyl alcohol".
Philipp. Agric., (1949) 32, 239-251.
A 93.4% extraction was obtained on a laboratory scale using 95% ethyl alcohol as a solvent.

115. CERIOTTI, A.
"Edible coconut oil".
Rev. Fac. Quim., Lima, (1935) 10, 27-35.
A review of the properties and uses of coconut oil.
(Chem. Abstr., (1936) 30, 7370^3).

116. CEYLON TRADE JOURNAL.
"Coconut oil".
Indian Cocon. J., (1951) 4, 179-184.
A general popular article.

117. CHILD, R.
"Edible coconut oil".
Trop. Agriculturist, (Ceylon). (1937) 89, 270-280.
A review of the processes of preparation of coconut oil.

118. CHILD, R.
"Coconut oil - properties and composition".
N. Guinea agric. Gaz., (1940) 6, 77-81.
A general article surveying the uses, properties, etc., of cocoonut oil. The composition based on the literature, is given: C_6 0.2-0.5, C_8 7.8-9.0, C_{10} 4.5-6.8, C_{12} 44.7-51.0, C_{14} 16.5-18.5, C_{16} 7.5-9.0, C_{18} 1.0-3.0, oleic 5.0-8.2, linoleic 1.0-2.6; saturated acids 91%, unsaturated acids 9%.

119. COLLIN, G. & HILDITCH, T.P.
"The component glycerides of coconut and palm-kernel fats".
J. Soc. chem. Ind. London, (1928) 47, 261T-269T.
Coconut oil oontains 84% fully saturated glycerides with dilauromyristans probably being the most abundant and trilaurin being absent. Of the mixed saturated-unsaturated glycerides (16%) monoleoglycerides constitute 12% and dioleoglycerides 4%.

120. CRUZ, A.O. & WEST, A.P.
"Water white coconut oil and coconut flour".
Philipp. J. Sci., (1930) 41, 51-58.
The oil was obtained by the cold pressing of desicoated coconut. It was water white and showed the following characteristics:

120. (Cont'd.)

Specific gravity $d\frac{30}{4}$ 0.9150, saponification value 261.4, iodine value 5.4, free fatty acids (as oleic acid) 0.05%, unsaponifiable matter 0.15%, refractive index (30°) 1.4522, water and volatile matter 0.03%. The meal that remained was white, contained 20% protein and could be made into an edible flour.

121. ELSDON, G.D.

"Alcoholysis and the composition of coconut oil". Analyst, (1913) 38, 8-11.
The composition of coconut oil possessing a saponification value of 258.4, iodine number 8.71, M.P. 24°, Reichart-Meissl value of 7.71, was shown to be approximately: C_6 2, C_8 9, C_{10} 10, C_{12} 45, C_{14} 20, C_{16} 7, C_{18} 5, oleic 2%.

122. ELSDON, G.D.

"Alcoholysis and the composition of oils and fats".
Analyst, (1924) 49, 423-426.
A discussion of the use of alcoholysis in the determination of fatty acids, and is illustrated by a comparison of published results for the composition of coconut oil.

123. ESCOURROU, R.

"Préparation des aldehydes C_{10}, C_{12}, C_{14} à partir de l'huile de coprah. (Preparation of C_{10}, C_{12}, C_{14}, aldehydes from copra oil)".
Bull. Soc. chem. Fr., 5th ser. (1939) 6, 1173-1181.
The acids obtained by the saponification of the oil were converted to the acyl chlorides and hydrogenated at 50 mm with a platinum catalyst yielding an aldehyde and a paraffin.

124. FERNANDEZ, J.S. & LOPES, M.C.

"Comestible coconut oil".
Rev. Dep. nac. Prod. anim., Rio de J., (1936) 3, 123-127.
Brazilian coconut oil has an iodine index of 16.2 and a refractive index of 1.4505.
(Chem. Abstr. (1937) 31, 6911^{8}).

125. FITELSON, J.

"The occurrence of squalene in natural fats".
J. Ass. off. agric. Chem. Wash., (1943) 26, 506-511.
Coconut oil was shown to possess 2 mg% squalene.

126. FREEMAN, S. & IVY, A.C.

"A comparison of rats fed on evaporated milk with those fed on "milk" in which the naturally occurring fat has been replaced by coconut oil". J. Dairy Sci., (1942) 25, 877-888.
The growth response of rats fed evaporated milk over a 97 day period was greater than those in which the butter fat was replaced by coconut oil.

127. JANTZEN, E. & WITGERT, H.

"Der Nachweis geradzahliger und ungeradzahliger Fettsäuren bei der Analyse von Kokosol. (The detection of even and odd numbered fatty acids in the analysis of coconut oil)". Fette u. Seif., (1939) 46, 563-572.
Fractionation of 120 Kg of the methylesters of coconut oil led to the isolation of C_9, C_{11}, and C_{13} fatty acids with a total concentration of about 0.5%. The melting points of these acids were determined as: C_9 12.5°; C_{11} 28.5°; C_{13} 41.5°.

128. GUTIERREZ, J.S.

"Studies on the continuous extraction of coconut oil with the use of ethyl alcohol". Philipp. Agric., (1951) 34, 133-143.
Methods using 95% hot ethyl alcohol as a coconut oil solvent are described.

129. HARRIS, R.S. & MOSHER, L.M.

"Comparison of nutritive value of refined coconut oil and butter fat". Food Res., (1940) 5, 117-184.
Rats were maintained on a diet of 72% skim milk, 3% extracted yeast, 25% butter fat or coconut oil supplemented with iron and vitamins A and D. There was a slightly better growth response from the rats fed coconut oil. No pathological effects were noticed with either diet.

130. HOAGLAND, R. & SNIDER, G.G.

"Digestibility of some animal and vegetable fats". J. Nutr., (1943) 25, 295-302.
Digestibility of various fats when fed to rats at a 5% level was: coconut oil 98.9%; soy oil 98.5%; corn oil 97.5%; butter fat 88.3%; mutton fat 74.6%. When fed at a 15% level the digestibilities were: soy oil 98.3%; corn oil 98.3%; coconut oil 96.5%; butter fat 90.7%; mutton fat 84.8%.

131. HOLT, L.M.
TIDWELL, H.C.
KIRK, C.M.
GROSS, D.M.
NEALE, S.

"Studies in fat metabolism. 1. Fat absorption in normal infants".
J. Pediat., (1935) 6, 427-480.
A general review of fats in pediatrics is given (117 references listed). Various fats and the ethylesters of fatty acids (including some with an odd number of carbon atoms) were tested for absorption. It is claimed that neither fat size nor melting point affect absorption, and that ethyl esters are inferior to triglycerides.

132. LAVA, V.G.

"Oil Recovery".
U.S. Patent No. 2,101,371 (1937).
A method of extraction of coconut oil from fresh coconuts is described.

133. LAVA, V.G.

"A new trend in the extraction of fixed oils with particular reference to coconut oil".
Rev. filip. Med., (1941) 32, 139-142.
An analysis of the oil obtained by the "Lava" process is given. (cf. entry No. 132).
(Chem. Abstr., (1941) 35, 5733^{1}.).

134. LAVA, V.G.,
TORRES, P.E. &
SANVICTORES, S.

"Chemical studies on coconut products III A new process for the extraction of coconut oil".
Philipp. J. Sci., (1941) 74, 247-281.
A complete report of the operation of a pilot plant for the "Lava" method of oil extraction using 500 coconuts per day is given. The yields, economics and by-products obtained are discussed.

135. LAVA, V.G.,
TORRES, P.E. &
SANVICTORES, S.

"Chemical studies on coconut products IV Further data on a new process for the extraction of coconut oil".
Philipp. J. Sci., (1941) 75, 143-156.
This is a continuation of the paper reported under 134.

136. LEPKOVSKY, S.
FESKOV, O.V. &
EVANS, H.M.

"The use of the fractionating column for the separation of fatty acids".
J. Amer. chem. Soc., (1936) 58, 978-981.
A discussion on the use of the fractionating column in the separation of the esters of fatty acids. The % composition of coconut oil is given as: C_6 0.5; C_8 9.0; C_{10} 6.8; C_{12} 46.4; C_{14} 18.0; C_{16} 9.0; C_{18} 1.0; oleic 7.6; linoleic 1.6.

137. LONGENECKER, H.E.

"Deposition and utilization of fatty acids of low molecular weight, and a fatty acid analysis of coconut oil".
J. biol. Chem., (1939) 130, 167-177.
Rats fed a high content of coconut oil in their diet deposit a high percentage of their body fats as "coconut oil fats".
Coconut oil composition is given as (methylester method):
C_6 0.8; C_8 5.4; C_{10} 8.4; C_{12} 45.4; C_{14} 18.0; C_{16} 10.5; C_{18} 2.3; C_{20} 0.4; Hexadecenoic 1.3; oleic 7.5; linoleic, trace.

138. MARIUS, -

"Coconut oil".
Nouva Riv. Olii. veg., (1935) 35, 49-51.
A summary of the occurrence and chemistry of coconut oil.
(Chem. Abstr., (1935) 29, 6450^7).

139. MEHLENBACHER, V.C.

"Fat and oil microscopy".
Institute Spokesman, (1941), 5, 1-4, 6-7.
Fats and fatty acids can be identified under the microscope by the examination of the crystal habit of the respective fat acid mixtures derived therefrom. Photomicrographs are given for fourteen fats including coconut oil.

140. MENEZES, F.G.T. & BANERJEE, B.N.

"The effects of refining on the digestibility of edible oils and fats".
Quart. J. Indian Inst. Sci., (1939) 2, 203-218.
Clarification, neutralization and decolourization does not adversely affect the digestibility of coconut oil, although peanut and cottonseed oils are affected.

141. MENEZES, F.G.T. & BANERJEE, B.N.

"Studies on the digestibility of edible oils and fats. II. Effects of sterols, carotene and vitamins on pancreatic lipase".
Quart. J. Indian Inst. Sci., (1945) 8, 7-30.
It is claimed that carotene, calciferal and cholesterol activate the lipase. Coconut oil is readily hydrolysed.

142. NHAVI, N.B. & PATWARDHAN, V.N.

"The absorption of fats from the human intestine".
Indian J. med. Res., (1946) 34, 49-58.
It is claimed that coconut oil is absorbed as rapidly as butterfat and more rapidly than peanut oil. This is said to be due to high percentage of lower fatty acids.

143. NOBORI, H.

"The fatty acids in coconut oil".
J. Soc. chem. Ind., (Japan), (1940) 43, 199-200.
Oil extracted from Hainan Is. copra showed the following physical properties: acid value 1.1; iodine value 8.7; Reichart-Meissl value 6.6; Hehner value 90.7% d $\frac{30}{4}$ 0.9203; M.P. 24.2°; saponification value 260.6; thiocyanagen value 6.7; Polenske value 12.5; unsaponifiable matter 0.38%; n $\frac{30}{D}$ 1.436; solidifying point 22°.
The fatty acids showed: neutralization value 263.5; iodine value 9.9; d $\frac{30}{D}$ 0.8999; M.P. 24.5; saponification value 268.4, n $\frac{30}{4}$ 1.441; solidifying point 23°.
An analysis gave: C_8 8.73; C_{10} 8.05; C_{12} 57.34; C_{14} 13.06; C_{16} 7.46; C_{18} 2.03; C_{20} trace; oleic 4.56; linoleic 2.31; hexadecenoic, nil.
(Chem. Abstr., (1940) 34, 8315[4]).

144. NOBORI, H.

"Properties and the fat acid constituents of coconut oil".
J. Soc. chem. Ind. (Japan), (1942) 45, 141.
It is claimed that C_{11} and C_{13} acids are present.
(Chem. Abstr., (1948) 42, 6140a.).

145. NOBORI, H. & KAWABATA, M.

"Studies on the properties and constituents of coconut oil. II. Properties of coconut oil from the islands of the South Seas".
J. Soc. chem. Ind., (Japan), (1940) 43, 382-383.
Oil from copra from the (then) Japanese mandate and other South Seas islands gave: oil content 64.74-69.26%; saponification number 255.9-271.0; saturated acids 92.6-93%; oleic acid 5.2-5.4%; linoleic acid 2.0%.
(Chem. Abstr. (1941) 35, 3839).

146. NOBORI, H. & KAWABATA, M.

"III. Constituents of coconut oil from the islands of the South Seas".
J. Soc. chem. Ind., (Japan), (1940) 43, 383-384.
An analysis of the oil gave: C_6 0.3; C_8 9.17; C_{10} 9.67; C_{12} 44.05; C_{14} 15.86; C_{16} 9.58; C_{18} 3.16; C_{20} trace; oleic 6.28; linoleic 1.53.
(Chem. Abstr., (1941) 35, 3840[7]).

147. RAO, S.D.

"Utilization of carotene from oils".
Nature, (1945) 156, 234-235.
Vitamin A was utilized less efficiently when fed in coconut oil to vitamin A depleted rats than when fed in cottonseed or peanut oils. This is attributed partly to the low linoleic acid content, 2% as opposed to 48% and 21% respectively, but more especially to the low vitamin E content, 0, 260, 286 μ /g respectively.

148. RICHARDSON, W.D.

"Coconut oil of high iodine value".
J. Industr. Engng. Chem., (1911) 3, 574.
It was observed that the oil from the parings (testa) had a higher iodine value : 40.25, than oil from the endosperm: 8.9.

149. ROY, T.K.
MUKHERJEE, S. &
GOSWAMI, M.

"Rancidity in vegetable oils. I. The oil of coconut".
J. Indian chem. Soc. industr. Edn., (1946) 9, 129.
The reducing sugars and albumins are suggested to act as antioxidants for the oil in the kernel. Light, moisture and heat cause the oil to rancify, whilst hydrogen at low temperatures inhibits hydrolysis, but does not prevent deterioration completely.

150. SCHANTZ, E.J.
ELVEHJEM, C.A. &
HART, E.B.

"The comparative nutritive value of butterfat and certain vegetable oils".
J. Dairy Sci., (1940) 23, 181-189.
Good growth was obtained with young growing rats fed diets containing butterfat, coconut oil, corn oil, soy oil, or cottonseed oil. The response, however, to butterfat was better than to the vegetable oils, due apparently to a factor in the saponifiable fraction.

151. SILVEIRA, L.

"The belier index of Brazilian vegetable oils".
Industr. y. Quim., (Buenos Aires) (1942) 4, 70-73.
Rev. aliment., Rio de J., (1945) 9, (6), 6-9.
The belier index for Bahia coconut is given as 14°.
(Chem. Abstr., (1946) 40, 2656^{5}).

152. SEN, P.B. &
MUKERJEE, K.

"The role of coconut oil triglycerides on calcium and magnesium absorption".
(Indian J. Physiol. All. Sci.), (1950), 4, 137-144.

152. (Cont'd.)

Pure coconut oil was recrystallized from acetone and four fractions obtained possessing varying physical and chemical properties. The 2nd fraction (M.P. 15° - 16°) had the greatest effect on calcium absorption and retention.

153. SOLIVEN, F.A. & de LEON, A.I.

"Liberation of coconut oil through bacterial agency".
Philipp. Agric., (1938) 27, 200-215.
Coconut milk was prepared from fresh coconuts and inoculated with a culture from fermented coconut water. The oil-water emulsion was broken and a high quality oil separated.

154. STOKOE, W.N.

"The composition of coconut oil".
Analyst, (1924) 49, 577-579.
Refined coconut oil obtained from Hull and Holland showed the following characteristics: Saponification value 258.0-258.9; iodine value 9.2-8.0; Reichart-Meissl value 7.15-7.45; Polenske value 16.0-16.6; Kirschner value 1.81-1.59; M.P. 25.3°-26.4°; free fatty acids (as C_{12}) 0.05-0.08%. The composition of the oils was: C_6 0.2-0.2; C_8 7.4-7.2; C_{10} 9.5-10.7; C_{12} 49.1-48.7; C_{14} 17.6-17.5; C_{16} 4.3-5.4; C_{18} 1.2-0.8; oleio acid 10.3-9.0; not determined 0.5-0.8%, respectively.

155. STOKOE, W.N.

"The rancidity of coconut oil produced by mould action".
Biochem. J., (1928) 80-93.
When coconut oil is exposed to Penicillium methyl-amyl, heptyl and nonyl ketones, the corresponding secondary alcohols and some free fatty acids are formed.

156. TANCHICO, S.S.

"Products from coconut oil wax".
Philipp. J. Sci., (1935) 54, 423-426.
When coconut oil is allowed to stand white crystals form which are soluble in organic solvents. They are not glycerides and are thought to be myricyl cerotate.
Several commercial uses are proposed.

157. TAYLOR, E.R. & CLARKE, H.T.

"The lower fatty acids of coconut oil".
J. Amer. chem. Soc., (1927) 49, 2829-2831.
Fractionation of 130 kilos of the methyl esters of coconut oil acids gave:

157. (Cont'd) C_6 0.46; C_8 8.7; C_{10} 5.6; C_{12} 45.0; C_{14} 6.5

158. TAYLOR, E.R. & CLARKE, H.T. "The lower fatty acids of coconut oil". J. Franklin Inst., (1928) 205, 136. The analysis given here was: C_6 0.47; C_8 8.0; C_{10} 5.7; C_{12} 45.2; C_{14} 16.5; higher esters 23.4%.

159. VAUBEL, W. "Coconut fat with a high iodine number". Z. off. Chem. (1912) 18, 46-47. These results were practically the same as Richardson's. (cf. No. 148). (Exp. Sta. Record, (1912) 27, 615).

160. WALKER, E.V. "Separation of octanoic and decanoic acids from coconut oils". J. chem. Soc., (1923) 123, 2837. The preparation of samples of the pure acid is described.

161. WALKER, H.S. "The keeping qualities and the causes of rancidity in coconut oil". Philipp. J. Sci., (1906) 1, 117-142. Experiments on the keeping qualities of coconut oil are described. It is concluded that the state of the copra is the important factor in determining the rancidity of coconut oil, and that light or air have only a little effect on the general keeping qualities of good oil.

MISCELLANEOUS

162. CLEMENTE, A. & VILLACORTE, M. "Some colloidal properties of coconut milk". Natural appl. Sci. Bull., (1933) 3, 7-10. Coconut oil is a triphasic system containing 47-53% water; 39.55-39.99% oil; 2.62-2.93% protein; 0.08-0.10% starch; 2.83-3.15% sugar and 1.10-1.34% ash. It shows a surface tension of 46-65 dynes/cm.

163. DARWIS, A. & GREVENSTUK, A. "Bijdrage tot de kennis der bongkerkvergiftigingen". (Contributions to the knowledge of Bongkrek poisonings). Geneesk. Tijdschr. Ned-Ind., (1935) 75, 104, 366. (O.S.R. News, (1951) 3, 263).

164. FISCHER, H. & HILGER, J.
"Zur Kenntnis der natürlichen Porphyrine X. Ueber Blutfarbstoff in der Hefe, Nachweis von Porphyrine in Pflanzen. (On the knowledge of natural porphyrine. X. Concerning blood-coloured pigment in yeast, detection of porphyrin in plants)".
Hoppe-Seil, Z., (1924) 138, 288-306.
Coconut water on hydrolysis with hydrochloric acid and extraction with ether gave typical porphyrin spectra.

165. de GOLDFIEM, J.S.
"Intoxications par produits exotiques".
Pz. méd., (1935) 43, 1419.
Coconut may be infected by Bacterium cocovenenans which produces a powerful central nervous toxin.

166. HOUSSAY, B.A. & MARTINEZ, C.
"Experimental diabetes and diet".
Science, (1947) 105, 548-549.
34% coconut oil in the diet protected rats completely from alloxan diabetes (160 mg/Kg alloxan), while a similar amount of lard caused a 100% mortality at this dose.

167. JONA, J.L.
"Osmotic equilibrium in the living body".
Proc. roy. Soc. Vict., (1911) 24, (new Ser.), 248.
The osmotic pressure of coconut water is given as 0.521 atmospheres.

168. KLEIN, J.
"Vegetable milk in infant feeding".
Arch. Pediat., (1933) 50, 205-210.
The use of coconut milk is suggested in infant feeding.

169. MERTENS, W.K. & van VEEN, A.G.
"De bongkrekvergiftigingen in Banjoemas I en II. (Bongkrek poisonings in Banjoemas I and II)".
Geneesk. Tijdschr. Ned-Ind., (1933) 73, 1223, 1309.
Mededeel. Dienst Volksgezondheid Ned-Indie, (1933) 22, 209. (Personal communication).

170. MERTENS, W.K. & van VEEN, A.G.
"Over het Bact. cocovenenans en zijn verspreiding. (On Bact. cocovenenans and its spreading)".
Handelingen 7 e Ned-Indie. Congress on Natural Sciences, (1935) 45.
(Personal communication).

171. RAMAKRISHNAN, C.V. & BANERJEE, B.N.
"Studies on Mold lipase. Comparative study of lipases obtained from molds grown on coconut". Experientia., (1951) 15, 434-435.
The activity of lipases from molds grown on coconut cake plus varying amounts of coconut oil was examined. Coconut cake plus 10% oil produced molds showing the highest lipase activity.

172. SPOCH, H.A., SMITH, J.H.C., STRAIN, H.H., MILNER, H.W. & HORDIN, C.J.
"Fatty acid anti bacterials from plants". Publ. Carneg. Instn., (1948) No. 586.
Irradiated coconut oil exhibited an anti-bacterial effect.

173. van VEEN, A.G.
"Ueber der Giftstoff der sogenannten Bongkrek-vergiftungen auf Java (On the poison of the so-called bongkrek poisoning of Java)". Rec. Trav. chim. Pays Bas., (1934) 53, 398. (Personal communication).

174. van VEEN, A.G.
"Ueber das Toxoflavin, der gelbe Giftstoff der Bongkrek. (On toxoflavin, the yellow poison of bongkrek)". Rec. Trav. chim. Pays Bas., (1934) 53, 257. (Personal communication).

175. van VEEN, A.G.
"Die Bongkreksäure, ein blutzuckersenkender Stoff. (Bongkrek acid, a blood sugar depressant)". Rec. Trav. chim. Pays Bas., (1935) 54, 373. (Personal communication).

176. van VEEN, A.G.
"Bongkrek acid, a new antibiotic". Documen. neerl. indones. Morb. trop., (1950) 2, 185-188.
A highly unsaturated fatty acid-like substance has been shown to occur in material causing bongkrek poisoning. This substance, which causes a severe hypoglycemia in animals, inhibits the growth of yeast and fungi.

177. van VEEN, A.G. & BAARS, J.K.
"The Constitution of Toxoflavin". Proc. Acad. Sci., Amst., (1937) 40, 498. (Personal communication).

178. van VEEN, A.G. & BAARS, J.K.
"Ueber das Toxoflavin, ein Isomeres von 1-Methyl-Xanthin (On toxoflavin, an isomer of 1-methyl-xanthine)".

178. (Cont'd.)

Rec. Trav. chim. Pays Bas., (1938) 57, 248-264. A yellow compound was isolated from bongkrek poisonous material. This compound was shown to be an isomer of 1-methyl-xanthine.

179. van VEEN, A.G. & MERTENS, W.K.

"Isolation of a toxic bacterial pigment". Proc. Acad. Sci. Amst., (1933) 36, 666-670. Yellow needle-shaped crystals were isolated from fermenting coconuts. M.P. 200°, soluble in water, fats and ethyl alcohol, contains nitrogen and appears to be a flavanoid. (Chem. Abstr., (1933) 27, 2771^{9}).

180. van VEEN, A.G. & MERTENS, W.K.

"De invloed van het bongkrekzuur op de koolhydraat stofwisseling. (The effect of bongkrek acid on carbohydrate changes)". Geneesk. Tijdschr. Ned-Ind., (1935) 75, 1059, 1116.
Arch neerl. Physiol. (1936) 11, 73.
(Personal communication).

181. van VEEN, A.G. & MERTENS, W.K.

"Bijdrage tot de kennis der bongkrekvergiftigingen. (Contribution to the knowledge of bongkrek poisoning)".
Medische Berichten, (1937) 2, 4.
(O.S.R. News, (1951) 3, 264).

* * * * * *

SOUTH PACIFIC COMMISSION: TECHNICAL PAPERS

Copies of all papers listed below may be procured from the South Pacific Commission, Noumea, New Caledonia, or from the South Pacific Commission, G.P.O. Box 5254, Sydney, Australia. Except where otherwise stated, price per copy is 2/- stg., post free by surface mail.

1. **The Co-operative Movement in the Gilbert and Ellice Islands.** By H. E. Maude. February, 1949. 31 pp.
2. **Community Development.** March, 1950. 27 pp., bibliography.
3. **The Village Library.** April, 1950. 9 pp., book list.
4. **Visual Aids in Education in the South Pacific.** By A. L. Moore, Visual Aids Consultant, Commonwealth Office of Education. April, 1950. 58 pp.
5. **Fisheries and Animal Health Research Projects of Significance for the South Pacific Region,** conducted under the authority of the Commonwealth Scientific and Industrial Research Organization, Australia. May, 1950. 9 pp.
6. **A Preliminary List of Economic Plants of New Caledonia.** By J. Barrau, Director of Agriculture, New Caledonia. July, 1950. 10 pp.
7. **A Preliminary List of Plants Introduced into Tahiti.** July, 1950. 21 pp.
8. **Insect Pests in the Wallis Islands and Futuna.** Extract from a report by F. Cohic, Entomologist, Institut Francais d'Oceanie. July, 1950. 30 pp.
9. **Report of Plant and Animal Quarantine Conference, Suva.** April, 1951. 24 pp., two annexures.
10. **Bibliography of Co-operation in the South Pacific.** April, 1951. 10 pp.
11. **Interim Reports on the Moturiki (Fiji) Community Development Project.** By Howard Hayden, Director of Education, Fiji. May, 1951. 48 pp.
12. **Tuberculosis Investigations by the South Pacific Commission in 1950.** May, 1951. 124 pp.
13. **Vocational Training Facilities in Australia for Students from South Pacific Territories.** May, 1951. 8 pp.
14. **Educational Broadcasts to Samoan Village Schools.** Department of Education, Western Samoa. May, 1951. 7 pp.
15. **Libraries for Beginners.** By Dr. and Mrs. Kenneth Todd, Kwato Mission, Eastern Papua. July, 1951. 21 pp., book list.
16. **Some Notes and Suggestions Regarding Conservation of Important Archaeological Sites and Archives in South Pacific Territories.** By Dr. F. M. Keesing. August, 1951. 19 pp., bibliography. (Price, 5/- stg.)
17. **Conference of Experts on Filariasis and Elephantiasis, Tahiti: Summary of Proceedings.** September, 1951. 22 pp.
18. **Report on Nutrition Investigations by the South Pacific Commission in 1950.** November, 1951. 77 pp., tables, graphs.
19. **Report on Copra Grading.** November, 1951. 20 pp.
20. **Research Workers in the South Pacific.** December, 1951. 15 pp.
21. **Note on the Mycoflora of Rice Seed in the Territories of the South Pacific.** By Dr. F. Bugnicourt, Director, Institut Francais d'Oceanie. January, 1952. 5 pp., appendices, bibliography.
22. **The Chemical Composition of the Milk of New Hebridean Mothers.** By F. E. Peters, biochemist, South Pacific Commission. February, 1952. 7 pp.
23. **Nutrition Research Conducted in New Hebrides during 1951.** By Sheila Malcolm, nutritionist, South Pacific Commission. April, 1952 51 pp., tables, graphs.
24. **A Survey of Leprosy on the Island of Nauru.** By Dr. C. J. Austin, Director, Makogai Leprosy Hospital, Fiji. April, 1952. 8 pp., table, graph, map.
25. **Report of Fisheries Conference, Noumea.** May, 1952. 46 pp., appendices.
26. **Further Education in the Cook Islands.** By P. F. Henderson, Officer for Further Education, Cook Islands. July, 1952. 13 pp.
27. **A Survey of Leprosy in the British Solomon Islands Protectorate.** By Dr. C. J. Austin, Director, Makogai Leprosy Hospital, Fiji. July, 1952. 12 pp., map.
28. **Coral as a Building Material.** July, 1952. 10 pp., bibliography.
29. **Current Research in the South Pacific in the Field of Economic Development.** July, 1952. 82 pp., map.
30. **Bibliography of Cargo Cults and other Nativistic Movements in the South Pacific.** By Ida Leeson, former Mitchell Librarian. July, 1952. 16 pp., map.
31. **Cocoa Plantation Management in Western Samoa.** By D. R. A. Eden, General Manager, New Zealand Reparation Estates, and W. L. Edwards, Assistant General Manager. October, 1952. 20 pp., diagrams.
32. **Types of Organization in Adult and Mass Literacy Work.** By D. B. Roberts, Organizer for Island Literature, South Pacific Commission. August, 1952. 10 pp.
33. **A Survey of Malaria in the British Solomon Islands Protectorate.** By Dr. R. H. Black, School of Public Health and Tropical Medicine, University of Sydney. November, 1952. 38 pp., appendices.
34. **Rhinoceros Beetle Control in the Kingdom of Tonga.** By L. J. Dumbleton, Plant and Animal Quarantine Officer, South Pacific Commission. November, 1952. 7 pp.
35. **The Purari Delta — Background and Progress of Community Development.** November, 1952. 37 pp.
36. **Cocoa Growing in Fiji Islands.** By D. H. Urquhart, former Director of Agriculture, Gold Coast. December, 1952. 20 pp., map, appendices.
37. **Cocoa Growing in Netherlands New Guinea.** By D. H. Urquhart, former Director of Agriculture, Gold Coast. January, 1953. 14 pp., maps, appendix.
38. **Coffee Growing in New Caledonia.** By D. H. Urquhart, former Director of Agriculture, Gold Coast. January, 1953. 27 pp., maps, appendix.
39. **Cocoa Growing in Western Samoa.** By D. H. Urquhart, former Director of Agriculture, Gold Coast. January, 1953. 22 pp., maps, appendices.
40. **Cocoa Growing in New Hebrides.** By D. H. Urquhart, former Director of Agriculture, Gold Coast. January, 1953. 30 pp., appendices, map.
41. **Social Problems of Non-Maori Polynesians in New Zealand.** By Rev. R. L. Challis, Pastor of the Pacific Islanders' Congregational Church in New Zealand. February, 1953. 15 pp., bibliography.
42. **The Co-operative Movement in Papua and New Guinea.** Prepared by the Registry of Co-operative Societies, Port Moresby. February 1953. 28 pp., sample co-operative society records.
43. **Research in Queensland on Tropical Plant and Animal Industries.** By J. Barrau, Technical Officer, South Pacific Commission. May, 1953. 70 pp., illus., maps, appendices.
44. **The Use of the Vernacular in Teaching in the South Pacific.** By G. J. Platten, Education Officer, Papua and New Guinea. June, 1953. 34 pp., appendices.
45. **The Nimboran Community Development Project.** By Dr. J. van Baal, Director of the Bureau of Native Affairs, Netherlands New Guinea. June, 1953. 42 pp., map, chart, appendices.
46. **The Koror Community Centre.** Reports supplied by the High Commissioner, Trust Territory of the Pacific Islands. August, 1953. 34 pp., photographs.
47. **Central Vocational Training Institution.** By F. J. Harlow. August, 1953. 82 pp. (Price 5/- stg.; plans available separately at 5/- stg. per set.)
48. **The Management of Coconut Plantations in Western Samoa.** By D. R. A. Eden. September, 1953. 32 pp., illus., diagram.
49. **The Social and Cultural Position of Micronesian Minorities on Guam.** By R R. Solenberger. October, 1953. 11 pp., map.
50. **Nutrition Investigation in New Caledonia.** By Sheila Malcolm. October, 1953. 33 pp., maps, graphs.
51. **A Bibliography of Co-operation in the South Pacific.** December, 1953. 17 pp. (Revised edition of Technical Paper No. 10.)
52. **Social Science Research in the Pacific Islands.** December, 1953. 34 pp. (Revised edition of Technical Paper No. 20.)
53. **Reclamation of Tidal Mud Flats in Tonga.** By W. Straatmans, Head of the Department of Agriculture, Nuku'alofa, Tonga. March, 1954. 18 pp., illus., tables, diags., bibliog.
54. **The Pacific Islander and Modern Commerce.** By V. D. Stace, Assistant Economist, Reserve Bank of New Zealand. March, 1954. 29 pp., illus., appendix, index.
55. **Grading of Fresh Fruit Exports from South Pacific Territories.** April, 1954. 14 pp., tables.
56. **Leprosy in Netherlands New Guinea.** By Dr. Norman R. Sloan. April, 1954. 16 pp., tables, map.
57. **Leprosy in the Trust Territory of the Pacific Islands.** By Dr. Norman R. Sloan. April, 1954. 18 pp., tables, map.
58. **Bibliography of the Nutritional Aspects of the Coconut.** By F. E. Peters. April, 1954. 35 pp.
59. **Dietary and Nutritional Problems in the Pacific.** By Dr. E. Massal. April, 1954. 13 pp.
60. **Some Aspects of Malaria in the New Hebrides.** By. Dr. R. H. Black. May, 1954. Illus., maps, graph.
61. **Malaria in the Trobriand Islands.** By Dr. R. H. Black. May, 1954. 60 pp., tables.