ABSTRACTS OF COMMUNICATIONS

The Fifty-fourth Meeting of The Nutrition Society was held at the London School of Hygiene and Tropical Medicine, London, W.C. 1, on Saturday, 28 May 1949, at 10.45 a.m., when the following papers were read:

Studies with Restricted Diets for the Rapid Induction of Liver Tumours in Wistar Rats by Butter Yellow.

By A. H. M. KIRBY, *Research Department, Glasgow Royal Cancer Hospital.*

Wartime modifications, R.D. 1 and R.D. 3, of the 'low-protein' diet of Miller, Miner, Rusch & Baumann (1941) gave very inferior incidences of liver tumours in Wistar rats receiving *N*: *N*-dimethyl-*p*-aminoazobenzene (DAB) in the diet. When duplication of the American diet became possible, R.D. 9, it was found that the incidence of tumours was still relatively low. It has since proved possible to obtain 100% incidence of liver tumours by 6 months in Wistar rats given DAB in a low-protein diet, R.D. 10, which allowed satisfactory growth.

Component	R.D. 1 (%)	R.D. 3 (%)	R.D. 9 (%)	R.D. 10 (%)
Casein (unextracted)	12	12	12	5
Potatoes, boiled	76	—	—	—
Starch	—	76	—	—
Glucose (monohydrate)	—	—	75	30
Corn grits (degerminated)	—	—	—	40
Salt mixture (Glaxo, L.D. 6)	4	4	4	4·5
Arachis oil	5	5	—	—
Cotton-seed oil	—	—	5	—
Lard	—	—	—	20
Cod-liver oil	1	1	2	—
Halibut-liver oil	—	—	—	1 drop/rat/month
Dried yeast (D.C.L.)	2	2	2	—
Vitab (rice bran extract)	—	—	—	(2)*
L-Cystine	—	—	—	0·5
DAB	0·06–0·07	0·07	0·06	0·06
Liver-tumour incidence	100 at 10 months	33 at 1 year	100 at 8 months	100 at 6 months

* Added to otherwise 100% diet.

Precise component(s) of R.D. 10 favourable to earlier tumour development cannot be indicated. Advantage of R.D. 1 over R.D. 3 is surprising as it contains much more protein and riboflavin (reckoned on a dry-weight basis).

Controls on R.D. 1 made satisfactory growth, but controls on R.D. 10 developed avitaminosis A unless halibut oil was given at least once a week.

REFERENCE

Miller, J. A., Miner, D. L., Rusch, H. P. & Baumann, C. A. (1941). *Cancer Res.* 1, 699.

The Alleged Interdependence of Vitamins A and C. By I. M. SHARMAN, *Dunn Nutritional Laboratory, University of Cambridge and Medical Research Council*

Mayer & Krehl (1948) reported that when male rats, maintained on a diet deficient in vitamin A, were dosed with ascorbic acid, their survival time was increased from 35 to more than 80 days, and their maximum weight from 175 to 302 g. Investigations in this laboratory have failed to confirm any such clear interdependence between vitamins A and C. In one experiment, weanling male piebald rats were kept on a diet deficient in vitamins A and C, until reaching approximately 70 g. weight, when one group received added vitamin C, and a second group continued to receive the basal diet with no vitamin C. A small increase was observed in the average maximum weight attained by those rats receiving ascorbic acid, but the increase was not statistically significant. In another experiment vitamin C was added to the diet when the animals had reached only 40 g. weight, but in this case the maximum weights attained were identical in the dosed and undosed groups, and no significant difference was found in the survival times. Variation in the strain of rats is suggested as one possible reason for the difference from the original American observations.

REFERENCE

Mayer, J. & Krehl, W. A. (1948). *J. Nutrit.* **35**, 523.

The Atwater—a Nutritional Unit. By H. M. SINCLAIR, *Laboratory of Human Nutrition, University of Oxford*

Rose (1927) introduced a share system for expressing food values, a share of each nutrient being $\frac{1}{30}$ of the daily dietary standard of that nutrient for a moderately active man; as views concerning dietary standards were revised, the value of a share altered.

For the calculation of the results of dietary studies we have for several years past expressed the nutritional composition of foodstuffs in terms of the supposed weekly nutritional requirements of an average moderately active women, these being taken as 1000 units in the case of each nutrient (she is chosen because her requirements for most nutrients are about those of the weighted mean requirements of the whole population). The unit is called the Atwater. Thus, 100 g. of whole summer milk has the following composition (the top line being expressed in Atwaters, the bottom line in the customary units—g., mg., i.u., etc.):

Calories	Protein	Animal protein	Carbohydrate	Fat
1·05	2·23	4·46	0·50	1·72
65	3·3	3·3	4·4	3·6
Iron	**Calcium**	**Phosphorus**	**Vitamin A**	**Carotene**
0·40	6·48	3·85	4·86	0·51
0·1	120	95	100	38
Vitamin D	**Vitamin B_1**	**Nicotinic acid**	**Riboflavin**	**Vitamin C**
0·20	1·62	0·40	4·59	1·62
1	0·04	0·1	0·17	1

By inspection of the top line, it is at once obvious that this foodstuff is a very important source of calcium, vitamin A, riboflavin, animal protein and phosphorus, but is a poor source of iron, nicotinic acid and vitamin D. Inspection of the bottom line, in which the units differ, gives no information unless units and requirements are considered. Further, no decimal points occur in the computation of the nutritional content of diets. It is, of course, very simple to convert this unitary system back into the customary units of weight.

An Atwater is a definite weight of a substance (or number of calories). As standards of nutritional requirements vary, the Atwater remains unchanged; the number of Atwaters needed by a person of particular characteristics alters. Applications of the unit will be shown.

REFERENCE

Rose, M. S. (1927). *The Foundations of Nutrition.* New York: The Macmillan Company.

Effect of Certain Sugars on Calcification. By G. H. BOURNE, *Department of Anatomy, London Hospital Medical College, London, E.* 1

If sodium alizarinsulphonate is injected into normal guinea-pigs it stains the bones red. This stain is more intense in the regions of most active calcification.

It has been shown (Bourne, 1943) that in scurvy the bones fail to stain with this dye but that if ascorbic acid is added to the diet the staining ability is regained. It has also been shown (Bourne, 1943) that the apparent absence of calcification in scurvy is not due to failure of the calcificatory mechanisms, but to inhibition of the production of the ossein (collagen) framework on which the calcareous salts are deposited.

Fifty guinea-pigs, on a scorbutogenic diet for 2 weeks, were given daily doses of 10 mg. of various sugars. For the last 3 days of the experiment they were injected each day with 1 ml. of a 2% solution of sodium alizarinsulphonate. All animals were of the same sex (male), and varied in weight from 200 to 280 g., and were animals which were still growing. Five of the animals were maintained on the scorbutogenic diet with no supplement, and five were given a daily dose of 10 mg. of vitamin C. Groups of four guinea-pigs were given 10 mg. each daily by mouth of a solution of the following sugars and related substances:

(1) D-Arabinose
(2) D-Glucose
(3) D-Mannose
(4) Sorbitol
(5) Sorbose
(6) Ketogulonic acid
(7) L-Rhamnose
(8) Rhamnolactone
(9) Sodium D-*iso*ascorbate
(10) Galactouronic acid

It was found that the pinkest bones were those of animals which had received ascorbic acid, rhamnose and rhamnolactone. All others showed very little staining.

Collagen (and the closely related substance, ossein) is made up of long chain protein molecules with carbohydrate and probably ascorbic acid linkages. Possibly the deficiency of collagen production in scurvy is due to the absence of sufficient vitamin C to maintain these linkages. It appears from these results that rhamnose and rhamnolactone might be able to replace vitamin C in this respect.

I am greatly indebted to Dr F. Bergel of Roche Products Ltd. for the sugars and ascorbic acid used in this work.

REFERENCE

Bourne, G. H. (1943). *J. Physiol* **102**, 319.

Plant-Protein Mixtures in Infant Feeding. By R. F. A. DEAN, *Department of Experimental Medicine, University of Cambridge and Medical Research Council*

The supplementary action of proteins from soya and various cereals, already demonstrated by rat experiments (Chick & Slack, 1946) has been tested in young children in German institutions, where the complete diets were controlled and recorded.

Preparations of soya, wheat and barley, with the cereals malted, were spray dried and used with success instead of milk; they provided 40–70% of the total calories in the diets, and nearly all the protein. The addition of small amounts of dried skimmed milk greatly enhanced the food value of the preparations when fed to rats and milk-soya-wheat-barley mixtures were especially well tolerated by the children, and enabled them to grow excellently.

Some unexplained irregularities in growth led to consideration of the importance of the inhibitor of trypsin now known to be present in soya. Its discovery raises the need to revalue all previous feeding trials with soya. Prolonged steaming of soya destroys the inhibitor and greatly improves the taste, and this method was used in the preparation of new mixtures in which fresh skimmed milk was incorporated before spray drying. Trials with the new mixtures on children of all ages up to 11 years suggested that optimum growth can probably be supported on a diet in which 5–10% of the total calories is provided by skimmed milk, and there is no other animal protein.

In attempts to cheapen the preparations, the use of other cereals has been investigated. The preliminary results are encouraging, and because the composition can be varied widely in accordance with the availability of the cereals and the protein requirements of different animals, foods of this kind may be valuable in many lands and in animal husbandry.

REFERENCE

Chick, H. & Slack, E. B. (1946). *Lancet*, **251**, 601.

Haemoglobin Levels in Pregnant Women. By H. E. MAGEE and E. H. M. MILLIGAN, *Ministry of Health, Whitehall, London, S.W.* 1

This is a preliminary account of a study of haemoglobin levels in women attending antenatal clinics in the Manchester area that has been in progress for the past 1½ years. The alkaline haematin and Medical Research Council grey wedge photometer method (Adcock, Magee & Milligan, 1948) have been used. The findings are classified according to duration of pregnancy (Table 1), according to whether or not they received iron and duration of pregnancy (Table 2), and according to parity, duration of pregnancy and whether or not they were taking iron (Table 3). In Table 1 the findings are compared with those obtained in two recent surveys.

The figures show:

(*a*) A decline of about 8% in the mean value from the 1st to the 3rd trimester.

(*b*) The levels are higher throughout than those obtained in similar women from all over the country in the M.R.C. survey of 1943 (Committee on Haemoglobin Surveys, 1945), but lower for the 1st and 2nd trimesters than in the 1943–6 survey of Hoch & Marrack (1948) in London.

(*c*) The taking of iron, usually gr. iii t.d.s., kept the Hb throughout at a level about 1·5–4% higher than in women who did not take iron; this difference occurred in women of all parities.

Table 1. *Mean haemoglobin (% Haldane): all women*

	1st trimester			2nd trimester			3rd trimester		
		Haemoglobin			Haemoglobin			Haemoglobin	
Place and year	No.	%	S.E.	No.	%	S.E.	No.	%	S.E.
Manchester area 1947–	100	93	0·68	421	88	0·36	529	85	0·35
London East-end 1943–6	—	95	—	—	90	—	—	85	—
Great Britain M.R.C. 1943	105	89	—	209	86	—	376	82	—

Table 2. *Mean haemoglobin (% Haldane): women taking or not taking iron*

Trimester	No.	Hb	Range	S.E.	Difference significant	Weeks taking iron
			A. Women taking iron*			
1	15	96	89–104	2·1	With A2 and A3	4·8
2	187	89	70–118	0·68	With A1 and A3	7·0
3	371	86	60–113	0·40	With A1, A2 and B3	14·0
			B. Women not taking iron			
1	85	92	59–108	0·77	—	—
2	234	88	67–105	0·53	With B3	—
3	158	83	60–112	0·72	With B2 and A3	—

* Usually ferrous iron gr. iii thrice daily.

Table 3. *Mean haemoglobin (% Haldane) according to parity, trimester and iron medication*

	No iron			Taking iron		
		Haemoglobin			Haemoglobin	
Trimester	No.	%	S.E.	No.	%	S.E.
			Primiparas			
1	42	93	0·97	9	90	1·54
2	104	89	0·72	88	90	0·73
3	51	83	1·1	187	87	0·62
			2nd pregnancy			
1	26	92	1·24	4	96	—
2	55	88	0·76	58	89	0·79
3	43	81	1·59	105	86	0·73
			3rd or more pregnancy			
1	17	91	2·1	2	98	—
2	75	86	1·12	41	89	1·3
3	64	83	0·99	79	84	0·86
Total	477			573		

(*d*) During the 1st and 2nd, but not the 3rd, trimesters the levels were higher in primiparas than in women who had had one or more children, but this difference was not found in women taking iron.

REFERENCES

Adcock, E. W., Magee, H. E. & Milligan, E. M. H. (1948). *Mon. Bull. Min. Hlth*, **7**, 165.
Committee on Haemoglobin Surveys (1945). *Spec. Rep. Ser. med. Res. Coun., Lond.*, no. 252.
Hoch, H. & Marrack, J. R. (1948). *J. Obstet. Gynaec.* **55**, 1.

Growth Factor for Pigs in Liver Extracts and its Relation to Piglet Anaemia.

By R. BRAUDE, *National Institute for Research in Dairying, University of Reading*

Results of three experiments showed that there is a factor in liver extracts which exerts a positive effect on the rate of growth of piglets reared indoors when they receive the extracts as a supplement together with iron. The factor has no effect on haemoglobin concentration in blood, and thus, by itself, does not prevent the development of anaemia in piglets reared indoors. The factor is not present in a yeast extract. It is not active in pigs reared out of doors. Litters born in winter respond much better to liver extract supplement than litters born in summer. The results justify a speculation that the growth factor involved is the recently isolated vitamin B_{12} or an entity closely associated with it. Experiments to substantiate this hypothesis are in progress.