Fig. 1 shows the curves obtained when the Bellier figures are plotted against the percentages of arachis oil.

An inspection of the curve will show that although the Bellier figures increase with the percentage of arachis oil in the mixture, the increase is not proportional and that there is a steep rise for percentages of arachis oil below 25 but when the arachis oil content increases further the Bellier figures rise only slowly to the maximum of 40° C. for arachis oil itself. The percentage of arachis oil in an unknown

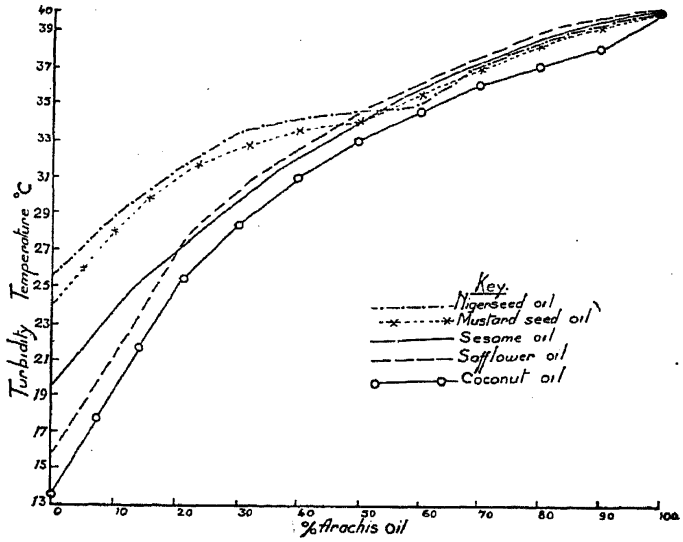

FIG. 1

sample, particularly when the percentage of adulteration does not exceed 50, is given with considerable accuracy by the Bellier figure.

The Bellier figure for genuine buffalo ghee ordinarily falls within the fairly narrow range of 28-30° and that for Vanaspati varies with the nature of the oil from which it was derived. But the values for some unquestionably genuine ghees departed considerably from this range.

My thanks are due to Mr. H. Hawley, Government Analyst, for his criticism, suggestions and encouragement, and to the Surgeon-General with the Government of Madras, for permission to publish this paper in *Current Science*.

King Institute,
Guindy, Madras, S. NARAYANAIER.
April 23, 1945.

1. *Analyst*, 1912, p. 487. 2. *Curr. Sci.*, June 1937. p. 640. 3. *Drugs & Galenicals*, 1937, p. 332. 4. *Abs. Analyst*, 1913, p. 58. 5. *Loc. cit.*

A SCIENTIFIC NEW YEAR'S DAY

SINCE the publication of the above note in *Current Science* of March 1945, 14, 68, it has been brought to my notice that there is nothing really scientific about January 1st being the New Year's Day. The argument was based on the fact that the day of the earth passing through the perihelion of its orbit has of late years been round-about January 1.

As a matter of fact, the date of perihelion is not permanent, and it is only by chance that it, at present, falls around January 1. The average date at the present epoch is January 2.

The mean tropical year, *i.e.*, the time between two successive vernal (or automnal) equinoxes, which determines the cycle of the seasons, is 365·24220 mean solar days. The time between two successive passages of the earth through the perihelion, known as the anomalistic year is, however, slightly longer. The mean anomalistic year has 365·25964 days. Thus the anomalistic year is longer than the tropical by 0·01744 of a day, or about 25 minutes, which makes perihelion come about seven days later in 400 years.

The actual time of perihelion passage fluctuates around its mean position by one or two days owing to slight irregularities in earth's motion and to the arrangement of leap years in our calendar, which will account for its variation between January 1, and January 4, during the period taken into account in the previous note.

Perihelion passage coincided with the winter solstice in about 1300 A.D. It will coincide with the vernal equinox in about 6500 A.D. at its present rate of progress.

The actual time taken by the earth to go round the sun, relative to a star, is the mean sidereal year of 365·25636 mean solar days. This is the most constant of the three types of years, changing by only a second in about 10,000 years. The tropical year changes by about a second in only 200 years.

The tropical year falls short of the sidereal due to precision of the equinoxes, which completes a full cycle in about 25,000 years. The anomalistic year exceeds the sidereal owing to the 'apse line', *i.e.*, the major axis of the earth's elliptical orbit gradually moving forward.

Government College,
Lahore, J. B. SETH.
May 18, 1945.

RELATIVE GROWTH PROMOTING POTENCY OF SOME STEROLS ON *CORCYRA CEPHALONICA* STAINT

A FAT-SOLUBLE factor for the growth and pupation of the larvæ of *Corcyra cephalonica* Staint has been shown to be essential; it was, therefore, of interest to determine whether the triglycerides, triolin, tristearin and tripalmitin in any way satisfied the fat-soluble requirement of the insect.

Newly hatched larvæ were fed for ten days on whole jowar and then transferred in weighed hatches to the experimental diets. Whole jowar and chloroform-extracted jowar were used as controls. Results are given in Table I. It may be observed from Table I that none of the triglycerides are useful in promoting the growth of the insect larvæ.

On the 21st day the larvæ were transferred from the triglyceride diets to whole jowar. The larvæ were weighed again after 11 days. The results show that the larvæ in spite of their arrested growth, retain their recuperative power and rapidly respond to the whole diet.

Our previous studies strongly suggested that sterols would probably supply the necessary

TABLE I

Average Weight of Ten Larvæ

Diet	Days					
	0	7	14	21	Weight of the larvæ 11 days after the transfer to whole Jowar	
I. Whole Jowar	5·03	24·7	121·88	394·70	Transferred to whole Jowar on 21st day	13 pupæ ; 1 larva
II. Chloroform extracted Jowar (C.E.J.)	5·60	10·68	8·98	8·63		85·48
III. C.E.J. + Triolein	5·32	9·37	8·72	6·90		79·33
IV. C.E.J. + Tripalmitin	5·36	10·85	8·32	6·67		110·91
V. C.E.J. + Tristearin	5·62	9·52	7·77	8·37		94·88

TABLE II

Average Weight of Ten Larvæ

Diet	Days				Remarks
	0	7	14	25	
A. With triolein					
I. Whole Jowar	1·80	16·46	81·50	Most pupated	Some pupated
II. Chloroform extracted jowar (C.E.J.)	1·98	2·46	1·88	No Survivals	No survivals
III. C.E.J. + Cholesterol	1·62	8·96	22·92	128·44	Some pupated
IV. ,, + Sitosterol	1·58	8·00	16·38	62·08	,, ,,
V. ,, + Phytosterol	1·62	9·34	27·78	145·92	No Pupæ
VI. ,, + Calciferol	1·72	2·58	3·72	3·82	,, ,,
B. Without triolein					
I. C.E.J. + Cholesterol	1·62	10·82	36·62	165·92	No pupæ
II. ,, + Sitosterol	1·66	11·54	36·08	122·28	,,
III. ,, + Phytosterol	1·86	11·22	20·64	102·40	,,
IV. ,, + Ergosterol	1·86	8·94	17·82	78·18	,,

TABLE III

Average Weight of Ten Larvæ

Diet	Days			Remarks
	0	18	25	
A. With triolein				
I. Whole Jowar	12·20	200·26	All pupated	All pupated
II. C.E.J. + Cholesterol	14·56	121·48	168·70	No pupæ
III. ,, + Sitosterol	12·84	70·94	136·12	Some pupated
IV. ,, + Phytosterol	13·50	91·14	186·00	Some pupated
V. ,, + Calciferol	15·32	11·58	No survival	—
B. Without triolein				
I. C.E.J. + Cholesterol	23·88	140·58	151·72	Some pupated
II. C.E.J. + Sitosterol	22·14	108·92	168·12	No pupæ
III. C.E.J. + Phytosterol	22·62	155·84	206·00	Some pupated
IV. C.E.J. + Ergosterol	24·02	129·98	170·64	No pupæ

fat-soluble growth requirement of the Corcyra larvæ; experiments were accordingly carried out supplementing the basal diet (chloroform-extracted jowar) with 1 mg./gm. cholesterol, ergosterol, sitosterol, phytosterol and calciferol respectively with and without the addition of triolein (4·28 g./100 g. of chloroform-extracted jowar). Results are given in Tables II and III.

From the above tables it may be seen that the cholesterol, sitosterol, phytosterol and ergosterol can each satisfy the fat-soluble factor requirements of the insect. The addition of triolein does not influence the rate of

growth nor the time required for pupation. Calciferol on the other hand does not support the growth of Corcyra larvæ and appears to exert a toxic effect.

(MISS) VIOLET DE SOUZA.
M. SREENIVASAYA.
Section of Fermentation Technology,
Indian Institute of Science,
Bangalore,
June 4, 1945.

ALGEBRA RELATED TO PARTICLES OF SPIN $^3/_2$

ONE of us (B. S. M.) has considered [(1942), referred to here as I], the question of deriving commutation rules for the matrices β appearing in the relativistic wave-equation of a particle of arbitrary spin in the form

$$\partial_\mu \beta_\mu \psi + \varkappa\psi = 0 \qquad (1)$$

of the famous Dirac equation for a particle of spin ½. It was there shown that this problem could be solved by making the new assumption that the spin operator $t_{\mu\nu}=i\, s_{\mu\nu}$ satisfies the condition

$$t_{\mu\nu} = (\beta_\mu, \beta_\nu) \equiv \beta_\mu\beta_\nu - \beta_\nu\beta_\mu \qquad (2)$$

for all spins.

The general commutation valid for all spins can then be written as

$$(\beta_\mu, t_{\nu\rho}) = (\beta_\mu, (\beta_\nu, \beta_\rho)) = \delta_{\mu\nu}\,\beta_\rho - \delta_{\mu\rho}\,\beta_\nu \qquad (3)$$

The special clases of spins $^3/_2$ and 2 were considered in I, and the restricted forms of (3) on the further assumption that the eigenvalues of $s_{\mu\nu}$ for a particle of spin s are s, $s-1$, ..., $-s+1$, $-s$, were also given there [I, (26) and (34)] for these cases.

The imposition of condition (2), while it solves this particular problem of deriving the commutation rules, has also very far-reaching consequences in that it makes wave-equation (1) itself of fundamental importance in obtaining properties of the elementary particles. Bhabha (1945, *a*, *b*, *c*) has recently considered the full implications of the assumption (2) and shown that the problem of finding all irreducible equations of form (1) can be connected with that of finding all irreducible representations of the Lorentz group in five dimensions. He has further shown that, on this theory, a particle of maximum spin n must appear with n different values of the rest-mass if n is an integer, and $n + ½$ values if n is half an odd integer, the higher values of the rest-mass being simple rational multiples of the lowest value.

On the basis of his new theory Bhabha has considered (1945, *c*) in particular, the two possible equations of the form (1) for a particle of maximum spin $^3/_2$, and indicated, by consideration of the non-relativistic approximation, that the equation given by one of the representations denoted by $R_5(^3/_2, ½)$ may possibly describe the behaviour of the proton. The degree of this representation, *viz.*, 16, and the explicit expression for the same have also been derived by him [*ibid.*, (74) and (76)].

We have independently investigated the algebra generated by the commutation rules for the case of spin $^3/_2$ [(I, (26)] exactly on the pattern given by Kemmer (1939) for the case of spin one (Meson algebra). The investigation is not too laborious on account of the fact that the algebra becomes the direct-product of two sub-algebras, one being the Dirac algebra of rank 16, and another, which we call the ξ-algebra, of rank 42. Thus there is really no need to count the 672 (16×42) linearly independent quantities generated by the β_μ, I and all powers and products of the β_μ. The dimensionality of the representations is then decided by the relation: $42 = 1^2 + 4^2 + 5^2$ pertaining to the ξ-algebra, and given by (4×1), (4×4), (4×5), *i.e.*, 4, 16 and 20 for the original algebra. Of these the first relates to the case of spin ½ and may be discarded. It can also be shown that the algebra for the case of all half-integral spins is the direct product of the Dirac algebra and an associated ξ-algebra.

The commutation rule for spin $^3/_2$ is likely to prove useful in investigations relating to the above-mentioned theory of Bhabha for the proton, and the associated ξ-algebra which is easier to handle than the original β-algebra might be used in the related calculations. We have also derived the representation matrices for the ξ-algebra in both the representations of orders 16 and 20.

The related results will be published in detail elsewhere.

B. S. MADHAVA RAO.
K. VENKATACHALIENGAR.
V. R. THIRUVENKATACHAR.
Department of Mathematics,
Central College,
Bangalore,
July 20, 1945.

Bhabha, *Curr. Sci.*, 1945, **14**, 89–90, (*a*); —, *Rev. Mod. Phys.*, 1945 (in course of publication), (*b*); —, *Proc. Ind. Acad. Sci.*, 1945. **21**, 241–64, (*c*). Kemmer, *Proc. Roy. Soc.* A, 1939, **173**, 91–116. Madhava Rao, *Proc. Ind. Acad. Sci.*, 1942, **15**, 139–47; *J. Mys. Univ.*, 1942, **3**, 59.

SCIENTIFIC RESEARCH AND INDUSTRY IN U.S.A.

WITH reference to his address on "Scientific Research and Industry in U.S.A.," published in the April 1945 issue of the Journal (*Curr. Sci.*, 1945, 14, 90), Sir J. C. Ghosh writes to us under date July 9, 1945, that "Some statements which been made on the basis of information which was given to me when I was in America regarding the oil fields in Bahrein Island and in Arabia. My friend, Mr. P. Evans, of the Burmah Oil Co., informs me that some of the statements made there may not be quite accurate."—ED.