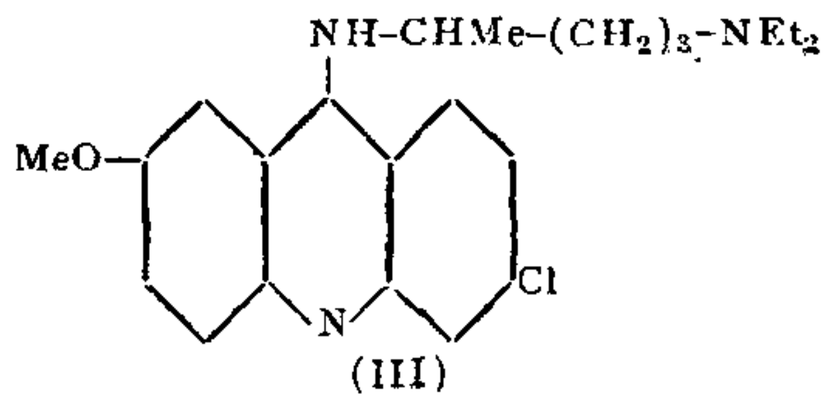
of cotarnine. These have been found to have antipyretic properties but Chopra and his co-workers[14] have found, however, that anhydrocotarnineresorcinol hydrochloride has no antimalarial action.

Atebrin (III), a synthetic antimalarial which is as remarkable as plasmoquine, was discovered by Mauss and Mietzsch in 1930. These investigators[15] found atebrin to be very effective against the schizont modification of the malarial parasite and consider that it should be very successful in conjunction with plasmoquine, which is effective against the gamete modification.



(III)

According to the discoverers of atebrin, the most varied acridine derivatives of the above type and other ring systems containing similar basic aliphatic side-chains (*e.g.*, triphenylmethane, thiazine, xanthine; see *Klin. Woch.*, 1933, **12**, 1276) are active antimalarials. Walls[16] has recently synthesised a phenanthridine derivative containing the same basic side-chain as atebrin. The pharmacological examination shows that phenanthridine is notably less active than its otherwise closely analogous isomeride acridine and differs from the latter in its lack of dermatitic and sternutative action.

The recent use of salvarsan and stovarsol in benign tertian malaria, as well as that of mercurochrome (dibromohydroxy-mercurifluorescein) suggests that the study of organo-metallic compounds would constitute an useful line of enquiry.

The difficulty of forming an accurate estimate of the value of any particular antimalarial agent arises from the fact that the actual infection cannot be transmitted to laboratory animals. This difficulty was partially removed when Roehl devised his technique of testing such drugs in bird malaria, using canaries as test animals, but ultimately one is dependent on clinical trials for confirmation.

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[14] Chopra, Mukherjee and Campbell, *Indian J. Med. Research*, 1933, **21**, 255.

[15] Mietzsch and Mauss, *Angew. Chem.*, 1934, **47**, 633.

[16] *J. Chem. Soc.*, 1935, 1405.

The Detection of Adulteration of Butterfat (Ghee).

(A Suggested Solution of an All-India Problem.)

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THE adulteration of butterfat (ghee) has been penalised by all the Provincial Governments of India and some of these have already taken very serious steps to punish the dealers in this important article of food, whenever the adulteration has been detected and proved in a law-court. Every province has got a special Chemical Analyser, whose business it is to examine and report on the samples of ghee (as also other food-stuffs) submitted to him for report. The act dealing with the prevention of food adulteration empowers the trying magistrates to decide the cases before them on the strength of the reports submitted by the special officers. In the interests of the vast public, it is but necessary to punish those who sell adulterated ghee (as also other adulterated food-stuffs). The responsibility which rests on the Chemical Analysers to the various Governments is therefore very great indeed. In the interests of justice and also in the interests of the public for whom justice is administered, it is of paramount importance that the investigation of the adulteration must be both scientific and correct.

In our investigation of this problem, we have come across certain points which need a very careful consideration. The main problem is, what are the correct physical and chemical constants of butter and butterfat from the scientific point of view? What are the limits of these? How is the purity or impurity of both butter and butterfat to be ascertained? Is there, in the first place, a correct knowledge of the composition of Indian butter or butterfat, from cows and buffaloes, either separately or mixed? Are the differ-

ent Provincial Analysts in India agreed on a unanimous standard of the limits of constants of pure butter and butterfat? Has sufficient work been done on the subject in India and have the chemists concerned met and discussed their experimental data obtained from Indian samples? All these questions must be answered and decided before any sample is pronounced as adulterated.

The results obtained in this Laboratory have already been published in the form of a booklet entitled *Butterfat* (by N. N. Godbole and Sadgopal) wherein certain new methods have been suggested. It is, of course, necessary that the methods proposed by us should be carefully examined by the Provincial Chemists before they are made generally applicable. It is, therefore, important to examine the various standards adopted by the Government Chemists in the different provinces of India. We are thankful to the various Chemists who supplied to us the information which has been put together in the following Table:

A brief summary of Standards adopted in various provinces of India for the purity of "Butterfat".

No.	Name of the Laboratory	Standards for mixed Butterfat		Remarks
		Refractive Index at 40° C. Butyro-reading	Reichert-Meissl Value	
1	Bengal, Government of	Not less than 40 and not more than 42·5	Not less than 28	Determination of Saponification value if necessary
2	Bihar and Orissa, Govt. of	40 to 42	Not less than 28	Phytosterol acetate test to be negative in all cases
3	Bombay Corporation	40 to 44·5	Not less than 24	
4	Calcutta Corporation	Not less than 40 and not more than 42·5	Not less than 28	Saponification value to be determined if necessary
5	Karachi Municipality	Not less than 40·5 and not more than 44·2	Not less than 24	Polenske value, Kirschner value and qualitative tests for hydrogenated oils are made when necessary
6	Lahore Municipality	Not less than 40 and not more than 41·6	24 to 32	Not more than 2·6 per cent. of free fatty acid allowed
7 & 8	Madras, Corporation of Madras, Government of	A general examination of the sample is made	Not less than 22, also should be above 27	Not more than 1 per cent moisture: Sterol acetate, Iso-oleic acid, etc. Isolation of Sterol-acetate, estimation of Iso oleic acid and other tests for a thorough examination
9	Mysore, Government of	——	——	No Standards are fixed as yet
10	Nagpur Municipality	From 40 to 46	From 19 to 36	——
11	New Delhi Municipality	——	——	No Standards are fixed as yet
12	Punjab, Government of	40 to 42	24 to 32	Baryta Value (Lallement's process to be negative. Free fatty acids to be not more than 2·8 per cent.)
13	Pusa, Agricultural Institute	Abbe's Scale 1·4524 to 1·4538	26 to 42	Saponification value and Iodine value (Hube) are also determined if necessary
14	United Provinces— (*a*) Agra (*b*) Lucknow	Not less than 40 and not more than 51 at 25°C.	Not less than 28	Moisture to be not more than 1 per cent. and Saponification value to be determined if necessary

From the above Table, it is clear that the different provinces in India are not only not unanimous in their criteria of the purity of butterfat, but they differ widely even in the limits of the values they have laid down. A student of science or a specialist in oils and fats will find the differences in the standards of different provinces too wide to be justified. Indeed, looking to the values tabulated above, it is clear that a sample which will be pronounced as pure by one Provincial Analyst will be dismissed as positively adulterated by another Provincial Chemist. It is high-time, therefore, that a conference of all the chemists interested in the investigation of butter and butterfat be called as early as possible to discuss :

(1) the limits of the physical and chemical constants of pure butterfat, and
(2) to standardise the methods for the detection of the adulteration, both qualitative and quantitative.

Coming to the scientific aspect of the standards, just at present, the Reichert-Meissl Value and the Refractive Index (with the help of the Butyro-Refractometer) are the two main tests by which the purity of butterfat is ascertained in all the provinces. It is true that values like the Saponification Value, Iodine Value, Lallement's Baryta Value, Kirschner Value or the tests for iso-oleic acid and phytosterol acetate are used in certain laboratories as supplementary tests to confirm certain doubtful results and to enable one to draw a positive or a negative inference. In our opinion, the Reichert-Meissl Value which has a range for pure butterfat from 19 to 35 is too good to be used ; instead of that, we have proposed that the so-called A- and B-values (Bertram, Bos and Verhagen) which possess a very narrow range, should be used. These Values have been found by us to be extremely satisfactory in their results. From an analysis of nearly two hundred samples of cow's and buffalo's butterfats from all provinces of India, we have ascertained that the B-value, which has a very small range, gives most reliable results. We would very much like that this be further examined by Chemists to the different Provincial Governments in India, with samples available in different provinces.

The great difficulty in the analysis of butterfat has been that the various constants of pure butterfat possess a very wide range depending upon the nature of the animal, the season and the *type of food* that is given to it. It has been our experience that the A- and B-values and especially the B-values offer the least range in the limiting values. It can be mathematically shown that whereas even a 5% adulteration of butterfat appreciably affects the B-value, the adulteration of even 20%, under similar circumstances, cannot enable the chemists with the help of Reichert-Meissl Value, etc., to draw any positive inference in pronouncing a sample as adulterated. We are not aware of any other laboratory in India where much preliminary work has been done on the application of A- and B-values for detecting the adulteration of butterfat quantitatively. Messrs. Carl Zeiss of Jena, in their most recent German pamphlet pertaining to the use of Butyro-Refractometer, have been good enough to mention the work done by us at this University as a reference book on the subject. It will be out of the place to enter into a theoretical discussion of A- and B-values in this present paper. The theoretical books on the subject of Oils and Fats have already published the necessary information.

The Reichert-Meissl Value, as adopted in India, is of doubtful Value for another reason also. Most of the vegetable and animal oils and fats (excepting cocoanut, palm-kernel and butterfat) have a Reichert-Meissl Value which is almost negligible. But Dolphin oil — a kind of fish oil — has got a high Reichert-Meissl Value of 39 to 112 with the result that if this is hydrogenated and added to butterfat (which we understand is being done), it will make the application of Reichert-Meissl Value of very little importance in pronouncing a verdict on the question of adulteration.

The application of Refractive Index, as observed in the Butyro-Refractometer of Messrs. Carl Zeiss of Jena, is from our point of view of very great importance, not merely because of the reading it gives but because of the characteristic colour-fringes which have been observed by us (in spite of the compensating prism) as also by a few of the earliest workers and which have been discussed in detail in our pamphlet, entitled *Butterfat*. We have drawn the attention of the numerous workers in this line to these characteristic colour-fringes and so far we have received no complaints to the contrary. Experiments are in progress in this University to photograph these coloured lines to show whether the sample of butter-

fat under examination is adulterated or not. The range of degrees in the Butyro-Refractometer as given by the different Provincial Governments is not in agreement with the observation which we have made and have collected in our trials of a few hundreds of samples of pure butterfat. The range which we have observed for pure butterfat at 40°C. is from 40° – 44·8° on the scale of the Butyro-Refractometer.

In some of the Provincial Laboratories (*Vide* U. P. Government standards) the observations are taken at 25° C. We fail to understand how a reading could be taken at 25° C. or why it should be taken at all at 25° C. when we know that many samples of pure butterfat have a melting point very much above 25°C. As is well known, no reading could be correctly taken in the Butyro-Refractometer unless the sample is *in a melted condition*, during the process of examination. We have found in the case of many adulterated samples that the range of melting point exceeds 44·5° C. and the characteristic colour-fringes—bluish green or orange red, etc.—betray the adulteration of the sample. For a qualitative test, which does not take more than a few minutes, we are of opinion that the observation of the Refractive Index *along with the Coloured Lines* is of great help in pronouncing an opinion on the purity of a sample.

Regarding the other Values like the Saponification Value, Iodine Value, Kirschner Value, sterols, etc. although these are valuable in themselves, we do not think that *directly* they are of much help. At best, they will render only *supplementary help*. But we would emphasise that the A- and B-values, if carried out carefully, will enable a chemist to draw perhaps the most accurate inference. The other values because of their wide range cannot be of much help unless they are all *put together*.

It is imperative in the interests of national health that a very effective legislation should be enacted to stop the adulteration of butterfat, one of the most important food-stuffs of the vegetarian dietary. But at the same time it is equally desirable in the interests of science and justice that the standards adopted in various provinces should be thoroughly examined, corrected, and re-arranged in order to protect the legitimate interests of the dealers in this article.

Centenaries in February 1936.

Gray (Stephen), 1696-1736.

FIFTEENTH of this February marks the bicentenary of the death of Stephen Gray. The exact date of his birth is not known. It is generally believed that he was born in the year 1696. What little is known about him is to be gathered only from the internal evidence contained in his contributions to the *Philosophical Transactions* of the Royal Society. He appears to have lived originally in Canterbury. But most of his experiments in Electricity appear to have been made in Charter House, where he was residing as a pensioner and in the residences of his friends, Wheeler and Godfrey.

ELECTRICS AND NON-ELECTRICS.

His first paper on electricity is the one entitled *An Account of some new Electrical Experiments* and published in 1720 in Vol. 31 of the *Philosophical Transactions*. In this paper, he added the following ten substances to the list of "Electrics" known before his time:—"(1) Feathers. (2) Hair. (3) Silk. (4) Linen. (5) Woollen. (6) Paper. (7) Leather. (8) Wood. (9) Parchment. (10) Ox-guts in which leaf-gold is beaten."

CONDUCTION OF ELECTRICITY.

His greatest discovery was that of the conduction of electricity. This discovery was made in 1729 but was published in the *Philosophical Transactions* only in 1731. "He made several attempts to carry the electric virtue in a line horizontally" and failed. At last, on June 30, 1729, "Mr. Gray went to Otterden-place, to give Mr. Wheeler a specimen of his experiments.... as also of the method and materials made use of." Giving up the nail as the supporter of the line of pack-thread, he used, as suggested by Wheeler, a silk line to support it. With this "they succeeded far beyond expectation. The first experiment was made in the matted gallery, July 2, 1729, about 10 o'clock in the morning." The experiment was repeated with success with increasing lengths of pack-thread, until they succeeded in transmitting the effect, some days later, to a distance of 765 feet.