M. Hume, D.SC., and also to Dr. K. Coward, D.SC., for suggestions as to modes of procedure. The method of producing a fine yeast powder suitable for irradiation was worked out at the Amritsar Distillery*. Facilities being absent in north India for the irradiation of large quantities of this material by ultra-violet rays, it was decided to experiment with exposure of the yeast powder (consisting of the product of several varieties of yeast) in a very fine layer to the action of direct sunlight for eight hours, after which the sun-irradiated yeast was stored in tins.

Patients chosen for this therapeutic experiment were known to be living on deficient diet and obtaining but little sunlight. Before treatment, the clinical condition of each patient was classified according to the degree of severity +, ++, +++, these headings being comparable to those used in previous records, and depending on the incidence, situation and amount of pain and deformity. After various trials drachm one of the sun-irradiated yeast powder, taken four times daily in either milk or water, proved to be a suitable dose for an adult. (Very occasionally patients complained of nausea in which case the dose was reduced.) Control cases received cod-liver oil drachms 2 daily.

Results.—The effect of treatment with four drachms daily of sun-irradiated yeast for four weeks is shown in the following table.

TABLE I

	+++	++	+	Nil.	Total cases.
Before treatment, degree of severity of clinical condition.	7	6	1	..	14
After four weeks treatment, degree of severity of clinical condition.	..	4	8	2	14

These patients put on weight and their general nutrition was improved at the end of four weeks, but five additional cases, who failed to take an adequate daily quantity of yeast, did not show any alteration at the end of the experimental period.

Discussion.—Fourteen patients, suffering from late rickets and osteomalacia, and living under conditions of deficient diet and sunlight, whose symptoms the use of a calcium-phosphate salt had not improved, showed decided improvement in their clinical condition after treatment with four drachms daily of powdered sun-irradiated yeast. Smaller doses, tried in five cases, failed to give relief. (The yeast used was a waste product, left over in distillery vats after fermentation, the only previous users being cow-herds, among whom the contents of the distillery-outflow tank had a reputation for curing sick cattle.)

The improvement in the nutrition of patients after treatment indicates also the value of the vitamin B content of the yeast.

Summary.—1. The possibility of utilizing waste yeast from Indian distilleries after sun-irradiation in the treatment of late rickets and osteomalacia is discussed.

2. It is suggested that such yeast may also be useful as a source of vitamin B in nutritional disorders.

* *Process of manufacture.* Yeast left over in the vats after the fermentation of molasses has been completed is washed, passed through a press and dried in the sun. It is then crushed in a disintegrator using a very fine screen, and again re-screened in order that the product may be in the form of a fine powder.

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MUSK: ITS PHARMACOLOGICAL ACTION AND THERAPEUTIC USES

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THE term 'musk' is loosely applied to a number of products of both animal and vegetable origin characterized by the peculiar odour of the true perfume. Musk proper is the dried secretion from the preputial follicles of the musk deer or *Moschus moschiferus*. The animals are found in China, Russia, Assam, Central Asia and in the pine forests and inaccessible cliffs of the Himalayas at elevations of about 8,000 feet. Musk is found in these animals only in the rutting season and is undoubtedly for the purpose of attracting the female. The season during which musk is present in the skin gland covers about one month, and in order to secure the valuable secretion of the gland the animal must be caught in that period. No musk is obtainable from animals in the other seasons of the year. The contents of the pod vary in bulk with the age of the animal. A yearling yields scarcely any musk and a two-year old fawn has in its skin gland contents one-eighth of an ounce of musk, which is milky, and has an unpleasant smell. A full-grown buck gives about two ounces, but specimens containing one-third to one-half of an ounce of musk are

not uncommon. The material is found embedded in a sac which is oval or round with a diameter of about 1½ inches; the upper surface is flat with a smooth membrane and the under surface is covered with stiff hairs arranged concentrically round a small opening. Though the quantity is small, the odour is so strong that it can be perceived at a distance when the animal is shot and it is said that the hunters very frequently suffer from the strong odour emanating from the fresh musk and that it acts deleteriously on the nervous system, eyesight and hearing. Chinese traders say that the best kind of musk is not obtained from captured animals, but is gathered from the favourite haunts of the deer after the rutting season, when the animal breaks the gland with its hoofs and empties the contents on the ground. Musk of this kind is extremely difficult to find and is, therefore, rarely seen on the market.

MUSK IN THE ANIMAL AND VEGETABLE KINGDOMS

It is interesting to note that odorous substances of the nature of musk occur both in the animal and vegetable kingdoms in different parts of the world. According to Gerardin (1928) the following animals secrete musk or similar odorous substances:—the male musk deer, *Moschus moschiferus;* also the gazelle, *Antilope dorcas,* the marten, *Mustela foina,* the fæces of which are said to have a musk-like odour; the alpine goat, *Capra ibex,* the dried blood of which smells like musk; the musk ox, *Ovibos moschatus,* which disseminates a decided musk odour and the meat of which, though it has a repulsive odour and taste, is eagerly eaten by the American-Indians; the zebu, *Bos indicus;* the pecari, *Dicotyles torquatus;* the musk-duck, *Anas moschata,* which is found on the Gold Coast, in Jamaica and Cayenne; the desman, *Myogal moschata;* the Nile crocodile, *Crocodilus vulgaris;* various turtles, *e.g., Cinosternon pennsylvanianum;* and various Indian snakes.

The musk odour is also found quite commonly in the vegetable kingdom. It is found in:—*Malva moschata* and the seeds of *Hibiscus abelmoschus* (*Malvaceæ*), *Brassica oleracea* var. *capitala* (*Cruciferæ*); *Erodium moschatum,* and *Geranium triste* or *Pelargonium noctuolens* of western Africa which is odorous at night (*Geraniaceæ*); *Rosa moschata* (*Rosaceæ*); the wax gourd, *Benincasa cerifera,* and the Indian bottle gourd, *Lagenaria vulgaris* (*Cucurbitaceæ*); *Adoxa moschatellina* (*Caprifoliaceæ*); *Achillea moschata, Aster argophyllus,* and *Moscharia pinnatifida* of Chile (*Compositæ*); *Hyssopus officinalis,* and *Moschosma* species of India and Africa (*Labiatæ*); *Mimulus moschatus* of Chile and North America (*Scrophulariaceæ*); *Moschoxylon swartzii,* the musk wood of Jamaica (*Meliaceæ*); *Guarea grandiflora* of America and the poisonous *Serjania curassavica* of America (*Sapindaceæ*); the wood of the American *Clusia eluteria* (*Clusiaceæ*); the Asiatic *Lawsonia inermis* (*Lythrarieæ*); the East Indian *Ferula Sumbul* (*Umbelliferæ*); the wood of *Cordia Rumphii* of Java (*Boraginæ*); *Pedalium murex* or *Peturaga Cingul* of Ceylon (*Pedalineæ*); *Cestrum nocturnum* of South America (*Solanaceæ*) and the Mexican wonderflower *Mirabilis longiflora* (*Nycoginieæ*), the last two named exhaling a musk odour at night.

Despite the large number of products capable of affording more or less a musk-like odour, the musk deer remains the only important commercial source of this substance.

Preparation of musk for the market.—There are several ways of preparing the commercial musk, and the best method is to dry the pod by sunning and airing immediately after it is taken from the animal. The article, because of its powerful diffusion of odour, is usually packed in hermetically-sealed vessels and wooden boxes lined with tin foil. The pods from the places of production are always packed in small skin bags singly, the pod inside the bag being covered with the animal's hair or similar stuff to keep its odour from diffusion as well as to protect it from the influence of the weather. For home consumption Chinese traders occasionally pack the pods in silk-wrapped packages of two or three dozens each. Musk is collected from the hunters by a class of trader, who is also engaged in exporting medicinal herbs and other products of the highlands of the Szechwan-Tibetan border, no Chinese merchant being engaged exclusively in the musk trade.

Commercial varieties.—There are three kinds of musk to be distinguished in commerce. (1) The Russian musk. This variety possesses a poor fragrance and hence is not much esteemed. (2) The Assam musk. It has got a very strong odour and fetches a much higher price than the other variety. In books on Hindu medicine Assam musk is described as 'Kamrup musk'. It is black in colour and has been considered to be the best variety available. At present the (3) Chinese musk is most highly prized because of its freedom from any unpleasant smell suggestive of ammonia which is sometimes found in the inferior brands. The bulk of the musk exported from China comes from Tibet, the home of the musk deer. It is bought up by the musk dealers of Tatsienlu, and carried to Chungking. The variety of musk known in commerce as 'Tonkin-musk' and chiefly used in perfumery comes from western Szechan and the eastern extensions of the Tibetan high plateau. Prior to the opening of steamer traffic on the Yangtse river in the past century, this variety of musk was exported *via* Tonkin to the South, it has retained the name Tonkin-musk to this day. The chief market for this article in the interior is located in the city of Tatsienlu, close to the border of Tibet. In the province of Yunan a certain quantity of musk is also obtained but it plays no rôle in commerce. A larger quantity comes to the market from the northern parts of Mongolia and Manchuria and from eastern Siberia. This musk is known by the designation 'cabardine' but is not used for first-class products because of its penetrating unpleasant odour.

Adulteration of musk.—On account of the great demand for musk and the difficulty of obtaining it, it is very frequently adulterated with inert substances such as dried blood, liver, etc. Vegetable products such as beans, wheat, barley, etc., are also mixed with the commercial article at the time of preparing. Musk quickly imparts its peculiar scent to other substances with which it comes in contact and detection of adulteration from smell is difficult. Several methods are in vogue amongst the Chinese and Tibetan dealers which, though not very scientific, are said to afford fairly good indications as to the genuineness of the article. Whenever any doubt exists, a few grains are extracted from the pod and placed in water. If these remain granular, the musk is genuine, and if these melt the musk is false or adulterated. Another test is to place a few grains on a live piece of charcoal. If they melt and bubble, the musk is pure; if they at once harden and become cinders it is adulterated. Genuine musk even when buried does not change its odour, while impure or adulterated musk gives out an entirely different smell. Adulterated musk can also be detected by touch. Genuine musk is soft and adulterated musk is stiff to the touch. An interesting popular test for musk has been reported from the Punjab. A thread is passed through asafœtida and then through the musk pod. If after this, the smell of asafœtida remains, the musk is not genuine.

Artificial musk.—Since musk fetches a high price on the market, the unfortunate little animal—the musk deer—has been ruthlessly hunted for its valuable scent pod. Fear has been expressed by foreign naturalists for the early extinction of the animal if the present rate of destruction is allowed to go on without any restriction. It is estimated that at least twenty-two pods are required to make one 'catty' of musk (thus twenty-

two male deer must be killed before the trade can bring one catty of musk pods to the market). As the musk sac is found on the abdomen of the buck only, and there is no distinction in appearance between the male and the female deer when seen at a distance many more animals of both sexes must be caught or killed, in order to secure a catty of musk pods. As the animals are hunted or trapped during the rutting season they are getting exterminated and this fact, coupled with the increasing consumption in perfumery of the article in France, has led the chemists to look for some substitute of the natural article which can be prepared in the laboratory. Compounds having the odour of musk have been prepared synthetically but such substances have entirely different chemical structure. These are not poisonous and are largely substituted in the cheaper forms of perfumery for the expensive natural product. The musk substitutes at present known are trinitro-meta-tertiarybutyltoluene and the corresponding compounds obtained from the homologues of toluene and the dinitro derivatives of the ketones which are formed by the interaction of acyl chlorides on derivatives of toluene. Trinitro-butyltoluol, $C_6HNO_3\ CH_3\ C_4\ H_7$, has been considered to be the best. Its odour is very akin to the natural musk and it is sold in perfumery under the name of artificial musk.

Commercial importance of musk.—Musk is very largely used in India and in the Far East. Besides its medicinal use, musk is employed extensively in perfumeries. France is the largest buyer, taking about one-third of the exports. Some idea of the commercial importance of musk can be obtained from the fact that the annual value of the exports from China alone varies between £70,000 and £100,000, to say nothing of the large quantity which is retained in China itself, where it is used not only as a base for perfumes but as an ingredient of stimulating medicines. It is said that some years ago the lamas of Tsarung in south-east Tibet, owing to the relentless killing of the musk deer, issued an edict prohibiting hunters from catching or killing the animal on very severe penalty. The edict is quoted as saying that any hunter caught killing musk deer will have his hands cut off and nailed on the temple door. In spite of the lamas' decree, with its terrible penalty, the quantity of musk brought out from the Tibetan border every year is fairly large.

A good deal of musk is also exported to the United Kingdom and other parts of the globe from India. According to Watt, the total amount of musk exported from India during a period of ten years from 1878 to 1888 was 44,195 ounces worth about Rs. 11,17,579.

Composition and physical and chemical characters.—Musk when fresh is milky, but later turns viscid and assumes a brownish-red colour. It retains its odour for a long time and has a bitter aromatic taste. It is soluble in alcohol to the extent of about 10 per cent., in water to about 50 per cent. and also in ether and alkalies. It stains paper yellow and gives a urinous smell on heating. It contains ammonia, olein, cholesterin, fat, wax, gelatinous matter, albuminous substances and leaves an ash, which contains chiefly the chlorides of sodium, potassium and calcium. Musk yields by distillation with steam and subsequent purification a small percentage of a viscid, colourless oil with a very powerful and agreeable odour of musk; this oil appears to be a ketone and has been termed 'muskone'. Musk is remarkable for the power, permanency, and stability of its odour, everything in its vicinity becoming affected by it and retaining the scent for a long time. It has been highly valued in perfumery and, though now not used alone, is very largely employed to give permanence and strength to other odours. Perfumers use the scent for imparting an odour to soaps, powders, and in mixing liquid perfumery. Its fragrance is completely destroyed by contact with bodies such as camphor, valerian, bitter almonds, garlic, hydrocyanic acid and powdered ergot.

Pharmacological action.—Little is known regarding the pharmacological action of this popular remedy. Most of the experiments recorded have been conducted with samples of musk obtained from the market which are likely to be, and as a matter of fact always are, highly adulterated. The tinctures of musk, both imported and indigenous, are not above suspicion. With a view to obviating any possible error in our observations, we obtained genuine samples of musk from a well-known practitioner of the indigenous system of medicine. These samples were collected from original musk pods from musk deer killed in the territories of the Rana Saheb of Tharoch (Simla Hills States), and also some were obtained from reliable dealers in Kashmir.

Solutions for pharmacological experiments were prepared in our laboratory by macerating the musk in a small quantity of alcohol and dissolving the whole in water, and keeping it for 24 hours. If the sample is moist, it can be dried in a vacuum desiccator over sulphuric acid when it loses nearly 15 to 20 per cent. of its weight of water. Musk is fairly soluble in water and by the above method of treatment 70 to 75 per cent. of the material goes into solution, leaving behind debris of vegetable and cellular matter. If the solution is heated, a little more musk goes into solution but this was avoided as this is likely to lead to escape of the volatile matter contained in the musk.

Action on the higher centres.—Musk has been used for a long time in the indigenous medicine in India as a nerve sedative in epilepsy, hysteria and convulsions in children. Indeed, in nearly all pharmacopœias, ancient or modern, there are included a group of drugs which are characterized by a very powerful odour and which have been employed as nerve sedatives. It is very difficult, however, definitely to substantiate, by experimental proof in the laboratory, the beneficial action of such drugs. Macht and Tung (1921) devised a technique for studying quantitatively the sedative effects of musk and other odorous substances on the central nervous system. A few drops of the solution of the aromatic drug were added to a wad of cotton in the neck of a funnel, under which rats were confined for about 15 minutes. The rats were then placed in the entrance to a maze and the time of traversing and the number of errors during their passage were noted. It was found that musk produced only a very slight depression of the higher centres, if any at all. In our experiments on animals in the laboratory, there was no evidence to show that musk

has a sedative action at all. In doses of 2 grains administered orally in several cases in the hospital, no sedative effect of the drug could be observed.

Action on the circulatory system.—Intravenous injections of 10 to 20 mgm. of the soluble portion of musk in 1 to 2 c.cm. of water, injected into the femoral vein of cats under chloralose anæsthesia, do not show any change in the carotid blood pressure. In higher doses also, very little effect is observed. In isolated hearts of rabbits and kittens perfused by the Langendorff method watery solutions of musk in concentrations varying from 1 in 1,000 to 1 in 200,000 do not bring about any alteration in the rate, rhythm and force of contraction of the heart. On the amphibian heart, injections of aqueous solution of musk in the lymph sac or under the skin of frogs do not produce any noticeable change. In the isolated heart of frogs also, perfused with Ringer's solution (0.6 per cent.), no stimulation of the organ is discernible on addition of weak or concentrated solutions of musk. Mudaliar, David and Reddy (1929) have also recorded similar observations with tincture of musk obtained from Messrs. Southal Bros. and Barclay Ltd., Birmingham.

Action on the cellular elements of blood.—According to Mudaliar, David and Reddy (1929) musk has a well-marked effect on the cellular elements of the blood. The total number of leucocytes is said to be increased after oral administration. This effect according to these workers is particularly marked in patients who have leucopenia, the total leucocytic count being doubled in some patients after musk, while comparatively little change is produced in normal individuals or in those with leucocytosis. They administered 10 to 20 minims of tincture of musk in an ounce of water and found that within ½ to 1 hour after administration the total leucocyte count showed a definite increase. In order to confirm these observations, we tried the drug on a series of six patients suffering from the leucopenia of kala-azar in the wards of the Carmichael Hospital for Tropical Diseases as well as on some normal individuals. We are very grateful to Dr. L. E. Napier for his courtesy in allowing us to give it to his patients. Powdered musk in doses of 1 grain was administered to these subjects 2½ hours after food daily for seven consecutive days and regular records were kept of the blood pressure, and of the rate, volume and tension of the radial pulse; the total erythrocytic and leucocytic counts were done at the same time. As the counts done soon after musk is given are likely to be fallacious on account of psychical and gastric reflexes set up by the drug, we made our observations at least two to three hours after the dose was given. The blood counts were made before the administration of musk and daily counts were made after its administration and again at the end of a period of seven days; even at this date no appreciable changes were observed in the cellular elements of the blood. The blood pressure, pulse rate, tension, etc., showed no appreciable changes. In healthy individuals (laboratory assistants) no change in the pulse rate, blood pressure or blood counts could be observed after two grain doses of musk. The subjects, however, stated that they felt a general sensation of well-being in the stomach and that the drug seemed to produce an effect resembling a dose of a carminative mixture containing essential oil which was administered to the same individuals with a view to comparing the effects. The results obtained with regard to blood counts, etc., in the kala-azar patients are given in the following table, p. 325.

Action on the respiratory system.—In animals under urethane anæsthesia, injections of 10 to 20 mgm. of soluble portions of musk in 1 to 2 c.cm. of water produce little or no change in the frequency, rhythm or intratracheal pressure. When, however, a cotton-wool pledget soaked in musk solution is brought in close proximity to the nose of such an animal, a distinct but very transient stimulation of respiration is noticed. This transient stimulation is also observed when a minute quantity of aqueous solution of musk is gently sprayed by means of a fine syringe into the nasal mucous membrane of the anæsthetized animal. The time taken for the stimulation in the latter case, however, is longer than when musk is brought in contact with the nose. This is probably due to the fact that odorous substances must be in a volatile state to produce typical odour responses through the olfactory nerve endings. Musk solutions when sprayed directly into the tracheal mucous membrane through an opening in the tracheal cannula, however, fail to produce even the transient stimulation noticed in the case of the direct application on to the nasal mucous membrane. These experiments show that musk has got no direct action on the respiratory system. Whatever slight stimulation of respiration is observed is probably entirely reflex, brought about by the stimulation of the olfactory nerves of the nasal mucous membrane which carry the impulses *via* the olfactory bulbs and tracts to the higher centres in the hippocampal gyrus. From these centres, the medulla is probably stimulated through the conducting fibres. This seems likely as musk is the most powerful of the odorous substances known. Valentin (1903) has estimated that a total of 0.02 mgm. (0.00,000,009 mgm. per litre) can be distinctly smelt by human beings. From this the strong sensory stimulation which is produced can be easily imagined.

Uses of musk in medicine.—Musk has been used by the Hindu physicians for a long time and forms a constituent of a number of preparations. In the *Bhavaprakasha* three varieties

TABLE

Name of patient	Blood pressure	Pulse rate	Erythrocyte count	Leucocyte count	REMARKS
R. P. ..	S/D = 90/42 mm. Hg.	80	2,790,000 per c.mm.	3,432 per c.mm.	Before musk.
	„ 96/42 „ „	86	2,840,000 „ „	3,276 „ „	3 hours after musk.
	„ 90/40 „ „	80	2,800,000 „ „	4,056 „ „	7 days after musk.
M. B. ..	„ 110/62 mm. Hg.	94	2,070,000 per c.mm.	3,120 per c.mm.	Before musk.
	„ 110/60 „ „	100	2,780,000 „ „	2,808 „ „	3 hours after musk.
	„ 106/64 „ „	100	3,100,000 „ „	2,340 „ „	7 days after musk.
S. A. ..	„ 106/44 mm. Hg.	96	2,810,000 per c.mm.	1,560 per c.mm.	Before musk.
	„ 110/44 „ „	94	2,520,000 „ „	2,028 „ „	3 hours after musk.
	„ 100/50 „ „	92	2,810,000 „ „	2,340 „ „	7 days after musk.
L. B. ..	„ 98/62 mm. Hg.	110	2,800,000 per c.mm.	4,056 per c.mm.	Before musk.
	„ 98/62 „ „	120	2,070,000 „ „	4,368 „ „	3 hours after musk.
	„ 106/64 „ „	96	2,270,000 „ „	5,304 „ „	7 days after musk.
D. ..	„ 90/50 mm. Hg.	110	2,640,000 per c.mm.	3,276 per c.mm.	Before musk.
	„ 90/52 „ „	110	2,840,000 „ „	3,432 „ „	3 hours after musk.
	„ 72/40 „ „	100	2,420,000 „ „	3,744 „ „	7 days after musk.
D. B. ..	„ 100/64 mm. Hg.	92	3,260,000 per c.mm.	3,588 per c.mm.	Before musk.
	„ 98/64 „ „	98	3,470,000 „ „	3,744 „ „	3 hours after musk.
	„ 102/58 „ „	96	2,790,000 „ „	3,744 „ „	7 days after musk.

are described, namely 'Kamrupa', 'Nepala' and 'Kashmira'. The first is described as black and superior to others, and probably consists of China and Tibet musk imported *via* Kamrup. That from Nepal is described as being bluish-black in colour and is of intermediate quality, while the Kashmiree musk is inferior to all. The Hindu physicians regard the drug as a cardiac and general stimulant, and as an aphrodisiac, and employ it as an anti-spasmodic, as an anodyne, in low fevers, in chronic cough, in general debility and in impotence. Its fame as a cardiac stimulant is so great that it is almost the last resort when everything else has failed to support the heart. As a cardiac stimulant, it is prescribed sometimes alone and sometimes in combination with '*Makaradhwaja*' (insoluble sulphide of mercury) and *Sida cordifolia* which contains ephedrine. It is said to stimulate the brain, the medullary centres especially the respiratory and vasomotor centres, the spinal cord and the peripheral nerves. It is believed to increase the arterial tension and is said to stimulate the urogenital organs. The elimination like that of the essential oils is said to be chiefly by the urine, but some is excreted by the sweat and milk. In low fevers with prostration, anæmia and general debility as a result of chronic ailments it is particularly valued. Its use as an aphrodisiac in sexual impotence has been very much in vogue. Tamil physicians in south India prescribe the remedy in convulsions of children, in combination with opium. It is also reputed to cure dyspepsia and colitis.

Musk was introduced into western medicine probably in the latter part of the sixteenth century. Since then, it has been prescribed as a stimulant in many ailments, *e.g.*, typhoid fever, typhus, gout, lock-jaw or tetanus, hydrophobia, epileptiform and hysterical attacks, chorea, whooping cough, hiccough, asthma, colic, etc. Crookshank (1905) spoke of the drug as being useful in acute specific infections resulting in toxic involvement of the central nervous system. He gave 5 grains of the powdered musk every 2 hours with satisfactory results. In convulsions of children where no definite causative factor can be determined, musk has been used with promising results in combination with chloral hydrate. Still (1906) recommended in such patients a rectal injection of chloral hydrate (gr. 5 to gr. 10 according to age) and tincture of musk (10 drops to 30 drops). It has also been used as a cardiac stimulant in failing circulation and palpitation of the heart under the belief that it raises the blood pressure and improves the character and volume of the pulse. Dr. A. Mitra of Kashmir (1898) found musk of great value in cardiac asthenia due to plague. The belief in the efficacy of the drug is, however, gradually changing. Musk was once official in the British Pharmacopœia but has since been removed. It was official in U. S. P. IX but has been deleted from U. S. P. X.

Tincture of musk is still very largely used by medical men in India in doses of 10 to 30 minims as a cardiac stimulant, in depressed conditions of the nervous system and as an aphrodisiac. Our own work, both experimental and clinical, does not bear out the cardiac-tonic and leucocyte-raising properties attributed to musk. Whatever stimulant effect it has is probably reflex from the olfactory nerves on account of its strong smell, and from the stomach on account of its slightly irritant effect on the mucous membrane. We have already observed that patients who had received a dose of musk have a feeling of warmth and well-being in the stomach and this may reflexly produce slight stimulation of the heart and respiration. There appears to be no foundation for belief in its efficacy as an aphrodisiac, in the treatment of epilepsy, of chorea and in convulsions of children. In hysteriform attacks it probably acts in very much the same way as strong-smelling substances such as asafœtida, valerian, etc. In whooping cough and colic its action probably resembles that of the essential oils group. From our observations we have come to the conclusion that the importance of musk as a cardiac and respiratory stimulant in the indigenous medicine in India has been very much overrated and that it has not any very marked physiological or therapeutic properties.

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OBSERVATIONS ON THE COMPOSITION OF BUTTER IMPORTED INTO BURMA

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TWENTY-TWO samples were examined representing the countries importing them. The origin in some cases was India, and no doubt the other brands are found on the Indian market. The observations and conclusions drawn from them are therefore of interest to India as well as Burma.

Descriptive details and the composition of the samples are shown in table I.

The water content was somewhat excessive in a few cases. Seven samples (3 Australian and 4 Indian) gave over 16 per cent., the generally-accepted standard, but in five of these cases the percentage was below 17, the other two being 17.04 and 17.50 per cent. respectively.

Several of the samples contained boric acid, although the quantity was not usually excessive. Where no preservative was shown to be present this result was quite independent of the origin of the sample, and it is important to note that one of these samples was described as being 'packed expressly for tropical climates'.

There appears to be no argument therefore for the use of preservatives. It is merely a matter of observing cleanliness in preparation.

The fat was thoroughly examined and table II summarizes the results obtained for the various analytical constants. They were generally satisfactory.

It is well known that butter-fat consists mainly of the triglycerides of the higher fatty acids, including variable amounts of butyric, caproic, caprylic, capric, lauric, myristic, stearic, palmitic, and oleic acids. Advantage is taken of the comparative volatility of the first five of these acids in the estimation of butter and its adulterants. Butyric acid is the most characteristic constituent of butter-fat and its relationship with the other acids possessing like properties is of paramount importance.

From the distribution of the Polenske and Kirschner values, and their relationship to the Reichert-Meissl value shown above, it would appear that the butyric acid content is relatively higher in Indian butters, with a corresponding lowering of the insoluble volatile fatty acids (caprylic, capric, and lauric acids).

This point might be usefully noted when the examination of butter is under consideration.

A CONTRIBUTION TO THE SURGERY OF FASCIAL TRANSPLANTATION

(WITH ILLUSTRATIVE CASES)

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OF late years grafts of fascia lata have been frequently used for reparative surgery. In the army these reparative operations are specially useful as one has to deal with cases of injury and their after-effects. The practical application of fascial transplantation is the outcome of experimental works by various observers. It can be used for diverse purposes, *e.g.,* treatment of hernia, adherent scars, repair of tendons, arthroplasty, etc.

In this paper the more popular uses of the graft, technique of the operations, and their results will be briefly discussed.

Anatomical considerations

The deep fascia of the thigh forms a tubular sheath for the muscles of the thigh, deep to