

Venkataraman, *ibid.*, 1934, 513; Mahal, Rai and Venkataraman, *ibid.*, 1120, 1769. 5. Späth and Lederer, *Ber.*, 1930, 63, 745. 6. Shriner and Hull, *J. Org. Chem.*, 1945, 10, 228, 288.

MANUFACTURE OF TAURINE

ALTHOUGH several processes exist for synthesising taurine, the method by which it could be made cheaply on a commercial scale was published recently by Goldberg¹ who reacted β -amino ethyl sulphuric acid with sodium sulphite with or without pressure to obtain a 70 per cent. yield of pure taurine. β -Amino ethyl sulphuric acid can be made in quantitative yields by sulphonation of ethanolamine after the method of Rollins and Calderwood².

The commercial process³ for the manufacture of taurine as worked by Messrs. I. G. Farben Industries, Germany, consists in the reaction of hydroxyethane sodium sulphonate with NH_3 at 200 atmosphere pressure and a temperature of 280°C . under nitrogen cushion. The hydroxy ethane sodium sulphonate is obtained by them by reacting a solution of sodium bisulphite with ethylene oxide also under inert atmosphere. These methods, as can be seen, are very difficult under present conditions in India.

The difficulty in Goldgerg's method is the separation of pure taurine from the reaction mass. The method employed is not only expensive but involves severe corrosive conditions.

This method is now modified by us with a view to making it attractive for commercial production.* β -Amino ethyl sulphuric acid (1 mol.) is boiled with sodium sulphite (1.1 mol.) for about 48 hours when the reaction is complete. The solution contains taurine together with sodium sulphate which is formed as a by-product. The boiling solution is then treated with a solution of calcium chloride (25% solution) taking care that no excess is added. Calcium sulphate which is formed settles rapidly. It is filtered and the resulting solution is concentrated to remove sodium chloride. Due to low solubility of sodium chloride, most of it is precipitated. The solution is filtered and then cooled in ice when crystal taurine crystallises, yield 80 per cent. of theory. The resulting solution contains probably di-taurine as a yellow waxy mass. Igepons as marketed by I. G. Farben Industry contains

sodium sulphate and sodium chloride as diluents.

For β -amino ethyl sulphuric acid we used a product marketed by B. F. Goodrich Co., Inc. Cleveland, Ohio, U.S.A., under the name of Goodrite β -amino ethyl sulphuric acid. It is available as white crystalline solid of 98 per cent. purity at a price ranging around 45 cents f.o.b.

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August 23, 1949.

1. Goldberg, *J.C.S.*, 1943, 4. 2. Calderwood, *J.A.C.S.*, 1938, 60, 2312. 3. Hoechst, *B.I.O.S. Final Report*, 418, 9.

* Between 2000-3000 tons of Igepons are imported at present annually and used in India in the making of paper, textiles, etc.

EFFECT OF STREPTOMYCIN ON GLYCERINE VACCINE LYMPH (CALF LYMPH)

CONTRARY to the views held by some workers,^{1,2} penicillin is ineffective³ in reducing microbiological contaminants of vaccine lymph.

Preliminary sterility tests on streptomycin-treated lymphs after its removal revealed that a concentration of 5 mg. per ml of streptomycin was necessary to destroy the staphylococcus group of organisms from the vaccine lymph. The staphylococcal population, about 252 millions per ml. of vaccine lymph before treatment, was reduced to a mere 240 per ml. within 24 hours contact in cold storage (-10°C) with streptomycin in 5 mg. concentration and to 40 per ml., in another week's time. A few of the *B. subtilis* group remained unaffected by streptomycin even in higher concentrations, possibly because of their existence as spores. In combination with 500 units of penicillin, as little as 500μ gm. of streptomycin per ml., of vaccine lymph gave almost the same result Bigger,⁴ Chain & Duthie,⁵ Himmelweit⁶ and Pulaski, *et. al.*⁷ find that certain antibiotics in combination with sulphanamides, bacteriophages or antibiotics produce such a synergistic action.

The potency of vaccine lymph is unaffected both by streptomycin and penicillin in contrast to chloroform which lowers the potency.

This is a finding of considerable practical significance and will not only lead to the preparation of a purer lymph but also contribute towards a substantial lowering in the costs of production.

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Bangalore City,
October 17, 1949.

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2. Patel, T. B., *Ind. Med. Gaz.*, 1948, 10, 452.
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4. Bigger, J. W., *Lancet*, 1944, 2, 142.
5. Chain, E., and Duthie, E. S., *Ibid.*, 1945, 1, 652.
6. Himmelweit, F., *Ibid.*, 1945, 2, 104.
7. Pulaski, E. J., et. al., *Ann. N. Y. Acad. Sci.*, 1946, 48, 183.

SOME OBSERVATIONS ON THE
BIOLOGY OF *TETRASTICHUS*
HAGENOWII, RATZ.—AN EGG-
PARASITE OF THE HOUSE-
COCKROACH (*PERIPLANETA*
AMERICANA, L.)

Tetrastichus hagenowii, Ratz. (Hymenoptera, Eulophidæ), is an egg-parasite in oothecæ of the cockroach, first observed in 1932; it has been bred here from the egg-capsules of the three common species *Periplaneta americana*, L., *P. australis*, F., and *Blatta orientalis*, L.

All the pre-adult stages of the parasite are passed well-protected within the egg-capsule of the cockroach. Eggs are laid by the female parasite inside the host eggs within the oothecæ. When freshly laid, the egg is smooth, shining and transparent; it is elongate-oval, with the caudal end narrow and somewhat curved; prior to hatching it becomes clouded and assumes a pale yellow colour. The newly hatched larva is smooth, flat and transparent and its segments fairly well defined; the fully grown larva (2.7 to 3.2 mm.) is white, tapering towards extremities, with abdominal segments opaque and dark brown owing to food contents inside; tracheal system well defined. Pupa (1.6 to 2.1 mm.) at first is white with eyes, mouth appendages, leg and wing rudiments clearly defined, later on changes to deep brown in course of chitinisation; the female pupa is bigger than the male pupa.

The period of development of the parasite from egg to adult averaged 23.6 days in October-November 1948, about 6 to 9 days

shorter than the incubation period of the egg of the cockroach (*Periplaneta americana*) at this season.

Period of observation: 26th October to 24th November 1948.

Period of development: 22 to 26 days \pm 6 hrs.
Temperature: Mean—73.2° F.; Maximum—84.8° F.; Minimum—62.3° F.

Emergence of the Parasites.—The number of parasites emerging from a host egg-capsule varied from 7 to 48, the average being 32.7. The ratio of females to males was invariably 3:1. Adult parasites escaped by biting holes (1 to 3) in the host egg-capsules, the presence of these emergence holes being the only external symptom of the parasitisation of the host egg-capsules. Emergence of the parasites generally took place in the mornings, and the parasites from one and the same host egg-capsule emerged on the same day. Soon after emergence, they became active, fed on dilute honey and copulated. Several female parasites were fertilised by the one male. The female parasites lived on an average 12.5 days when fed on dilute honey, and 7.8 days without food, the male only 3.4 days.

Natural incidence.—The incidence of the parasites was studied from host egg-capsules collected at random in Bangalore periodically.

Percentage of natural parasitisation of the egg-capsules of Periplaneta americana, L., by Tetrastichus hagenowii, Ratz.

Period	No. of cockroach egg-capsules		Percentage of parasitisation
	Examined	Parasitised	
July 1947– June 1948	495	102	20.6
July–Dec. 1948	288	123	42.7
July–Oct. 1949	178	103	56.7

The parasites were in abundance and most active during the period from September to November; when they parasitised 43.0 to 62.2 per cent. of the host egg-capsules. August to October is also the main egg-laying season of the host cockroach. It was observed that from a number of parasitised host egg-capsules the parasites did not emerge; this appeared to be due to two causes: (i) overpopulation of the developing parasites in the egg-capsule, which stifled their complete