fact, this is a point that has struck all the dental surgeons who have visited the clinic, and they have remarked upon how little fear the children display, and the lack of crying and noise during operations.

Experience gained during the war points to the fact, and our results so far are confirming this, that it is to young women intensively trained we must look for the solution of such problems as these.

As has been stated previously, the work of the nurses is limited to the treatment and filling of deciduous teeth, fillings in permanent teeth where the pulp is not involved, extractions of deciduous teeth, and first permanent molars. Their training is such that after they leave the training school *continuous personal* supervision by a qualified dentist is unnecessary. Regular visits of inspection are made frequently, and our system of charting is such that treatment performed can be traced to any operator at any time.

I should like here to say that I am of opinion that something more than attacking the problem at school age should be done, as much of the damage occurs at what might be termed the "neglected period" prior to school age, and parents with children aged from two years upwards are invited to bring them to the surgeries for inspection and minor treatment, when advantage is taken by the nurses to advise parents as regards proper diet.

Of course, the scheme was not inaugurated without considerable opposition. Our proposals were placed before the executive of the New Zealand Dental Association, who naturally approached the matter with a considerable amount of suspicion, but the facts we were able to bring before them, and the arguments used, were sufficient to persuade them of the soundness of the scheme, and a motion in its favour was carried by an overwhelming majority, and I am glad to be able to say that all opposition has now ceased, and, after visiting the training school and seeing the nurses at work in their surgeries which have been established throughout the Dominion, and inspecting the treatment performed by them, many of the strongest opponents are now heartily supporting the scheme. In fact, at the annual conference of the New Zealand Dental Association, held in May, 1923, a resolution was unanimously passed supporting it, and strongly advocating that the Government should extend it as rapidly as possible. Nor is the commendation confined to members of the medical and dental profession in this country.

The following is a summary of the operations performed by the dental nurses, 23 in number, who have completed training and were placed out in May, 1923:—

May, 1923, to 31st March, 1924.

Fillings.	Extractions.	Minor Operations.	Total Operations.
31,775	24,362	11,542	67,679

These figures do not, of course, include the treatment performed by the qualified dental surgeons, or that performed by the trainees at the Training Clinic, Wellington.

COOLING

PROBATIONER DENTAL NURSES: SYLLABUS OF TRAINING.

FIRST YEAR.

Chemistry.—An elementary general knowledge of chemistry to serve as an introduction to physiology.

Biology and Dental Anatomy.—A general elementary knowledge of cell structure and development; the development, eruption, and structure of the teeth.

Anatomy.—A general knowledge of the bones, muscles, vascular, nervous, digestive, and excretory systems, with more minute study of the structures of the head and neck.

Physiology.—A general knowledge of circulation, respiration, digestion, absorption, nutrition, and excretion.

Histology.—An elementary knowledge of the microscopic appearance of the principal tissues of the body, with special reference to the mouth and teeth.

Preliminary Operative Course.—A short course of lectures on filling materials and cavity preparation, followed by a course of practical operative work. The latter consists of the preparation and filling of cavities in extracted teeth, mounted in dummy heads.

SECOND YEAR.

Dental Surgery and Pathology.—Abnormalities of position of teeth; saliva and calculus; etiology and pathology of dental caries; treatment by filling and by extraction (*Note.*—Root filling is not taught); prevention of dental caries (special attention is given to this); injuries to teeth; diseases of pulp, periodontal ligament, &c.; fracture and dislocation; use of local anæsthetics.

General Pathology.—An elementary knowledge of bacteriological processes, inflammation, infection, shock, and collapse, affections of mouth, face, and lips, recognition of infectious diseases in children.

Materia Medica.—The chief drugs used in dentistry—their uses and actions, symptoms of poisoning, antidotes.

Operative Dental Surgery.—During their second year, the probationer dental nurses examine, chart, and, under supervision, carry out the treatment necessary for the children that present themselves at the clinic attached to the training school.

Examinations.—In addition to the usual class examinations, a primary examination is held at the end of the first year, and a final examination at the end of the second year.

These examinations are conducted by the medical and dental officers of the Department of Health.

A Mosquito Survey of Townsville.*

By L. E. COOLING, Entomologist, Australian Institute of Tropical Medicine (Commonwealth Department of Health), Townsville, North Queensland.

IN the course of the Townsville mosquito investigations conducted by this Institute during the months of September and October, 1923, and subsequent to this time, many inspections of breeding places have been made with a view to studying the prevalence of domestic and non-domestic mosquitoes, and the conditions contributing thereto.

* *Résumé* of a Report on a Mosquito Survey at Townsville carried out by the Australian Institute of Tropical Medicine in co-operation with the Townsville City Council.

In respect of the domestic mosquitoes, these surveys have comprised chiefly an examination of the location and extent of their breeding places, and have involved mainly house-to-house visitations and a small amount of inspection work on the larger breeding places.

Observations on the breeding places of the non-domestic species have involved more extensive travelling, especially in the location of salt marshes.

Although many species of mosquitoes have been recorded from Townsville—either through different periods of the year, or from year to year—only a very few species are responsible for the annoyance caused to inhabitants. These are—

Aëdes (Stegomyia) ægypti Linnæus.
Culex quinquefasciatus Say.
Anopheles annulipes (with its variety *amictus*).
Aëdes (Ochlerotatus) vigilax (Skuse).
Culex sitiens Wiedemann.
Culex annulirostris Skuse.

The most common (if not the only) day-flying species encountered indoors is *Aëdes ægypti*. In favorable seasons *C. 5-fasciatus* is rather numerous by night. These two species might be regarded as the only strictly domestic mosquitoes of Townsville. It is true, however, that with favorable conditions peculiar to it, *Aëdes (Finlaya) notoscriptus* may cause annoyance much as *Aëdes vigilax* does.

The remaining species are both seasonal forms and non-domestic—that is to say, habitation is not necessary to their perpetuation.

For the purpose of this paper the breeding places in Townsville might be classified roughly as follows:—

(i) *Artificial*, including all domestic supplies of water lodging only about household property. Rain-water tanks, sagged portions of roof guttering, water-barrels (liquid manure and rain water), jardinières, ant-traps which insulate the legs of food-safes, bedroom water-jugs, cesspools, septic tanks, and so on.

(ii) *Natural*, including swamps, pools, and watercourses; this group is naturally divided into two sections, viz.:—
(*a*) Fresh waters (polluted and unpolluted).
(*b*) Salt waters.

As observed, generally speaking, in other parts of Australia, these breeding places are associated with distinct species of mosquitoes or groups of species. For example, the larva of *Aëdes (Stegomyia) ægypti* has never been observed by the writer in water lodging on the ground.* Likewise might be said of *Aëdes (Finlaya) notoscriptus* which naturally selects the water-holding cavities in the boles of trees, garden water-barrels (especially about secluded arboreal situations like ferneries), and, in Perth, rain-water tanks.

* Of course, I have not infrequently observed what were obviously accidental artificial transfers of carvæ to puddles on the ground, especially to those under the taps of rain-water tanks. In this connexion it is indeed somewhat surprising to observe how often the error is repeated in text books on tropical medicine and such other works, that drainage and sewerage should be adopted to rid a place of *Aëdes ægypti* and yellow fever.

Associated with the natural fresh waters we have chiefly *Anopheles annulipes** (with its variety *amictus*) and *Culex annulirostris*, while in connexion with the salt marshes we have *Culex sitiens*, *Aëdes (Ochlerotatus) vigilax* and *Mucidus alternans*.

Another type of natural breeding place is that which has been polluted by sewer and drain outfalls; such contaminated watercourses (along with the strictly artificial ones like septic tanks, liquid-manure barrels, &c.), are responsible for the strictly nocturnal household-haunting species—*Culex quinquefasciatus* or the intermediary host of *Filaria bancrofti*.

It is, therefore, maintained that (in Queensland at least) filariasis is associated with *C. 5-fasciatus*,† which in turn is associated with polluted waters. These polluted waters, in turn, are the outcome of a congested population such as is found in a growing town or city which makes no provision for sewerage. In smaller towns or villages (especially in seaside towns where sewers might be discharged into the sea without nuisance), polluted waters are found only as a result of two factors, viz., a waterlogged soil (which generally is not sandy), and the disregard to sewage disposal.

One of the first conditions which strikes the observer in Townsville is the absence of long sewers. The coastal situation of the place renders it practicable to empty sewage into the sea. Thus, stream-pollution, which would, in a place like Brisbane, be the inevitable outcome of such sewage disposal, is not in evidence in Townsville. House drains, here and there, open on to the footpaths. When we further compare the two cities, Townsville and Brisbane, we find that the former is not possessed of large manufacturing establishments which contribute towards the difficulties of sewage disposal. For example, tanneries and fellmongeries are absent; meatworks are situated not only on the outskirts of Townsville, but in such a position that the sewage from the works discharges more or less directly into the sea.

The high dilution to be had in Ross River, Ross Creek, or Cleveland Bay is sufficient to render innocuous (from the mosquito stand-point) the small amount of sewage which is discharged by the few sewers. Other than one or two very prolific sources which contribute towards the nocturnal mosquito annoyance indoors in certain quarters of the town, Townsville as a whole may be regarded as owing its comparative freedom from *C.5-fasciatus* to its proximity to the sea (and in consequence its few polluted streamlets), and to its limited quantities of stagnant sewage (which follow, to a great extent, on rapid percolation through a sandy loam). Comparing the filarial endemicity of the two cities, Brisbane and Townsville, we find it is 4.9 per cent. : 1.4 per cent. (Sweet, 1923, p. 27). When we recall the findings of McLean

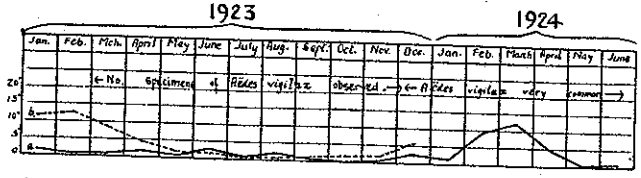
* Not infrequently this mosquito (with its varieties) selects salt marshes, but not in such a marked degree as has been asserted in quotations from authors.

† The statement here made, and often repeated by me, that *C.5-fasciatus* naturally selects polluted waters, does not, in any way deny the fact that, in certain places in Australia (especially in sparsely settled districts in sandy places, like Derby and Broome in Western Australia, for instance), *C.5-fasciatus* adapts itself to breeding in clean waters as in rain-water tanks. The case is undoubtedly one of adaptation, but it might be mentioned here that where this species has to compete with *A. ægypti* in having to rely on clean waters of domestic nature, it is always more scarce in numbers than its *confrère*, *A. ægypti*.

(1910) who observed that in 1,200 patients admitted to the Brisbane General Hospital, 130 of whom, or 10.8 per cent., having harboured embryos of *F. bancrofti*, we are somewhat struck with the discrepancy. While McLean's examinations were done at night (between 10.30 p.m. and midnight), many of those of the Hookworm Campaign authorities were done during the daytime. McLean stated that of the 130 cases of filariasis, 110 came from "Brisbane and the suburbs." Unfortunately, when results are "pooled," or when no exact statistics are either taken or published, the biological and sanitary significance is obscured. It is certainly insufficient to give the filarial endemicity for a whole city where, as is frequently the case (Brisbane and Townsville as instances), only a comparatively small portion is infested by the required species of mosquitoes. Districts selected for examination in connexion with filariasis should be grouped approximately in areas having as nuclei well-known or favorable breeding-places of the intermediary host. Similarly is the case with Railway Estate, Townsville, where a very fruitful breeding-place of *C.5-fasciatus* occurs in the midst of a rather dense population, and which does not find a parallel with other parts of the town. In other words, in a town of large size, provided that the class of inhabitant is stationary, the filarial endemicity is likely to be heavier in certain portions—a condition being governed by the type of soil, the drainage and sewerage of the area, the congestion of population, and the proximity of the people to breeding-places for the susceptible species of mosquito.

Our Townsville inquiry, except for the essentially domestic species of mosquitoes, was conducted during a very unfavorable period. For many months previous the whole district had experienced very dry weather. Marshes and watercourses which have been known, in past years, to breed mosquitoes, were in evidence during the investigation only as sun-parched ditches or plains of baked mud. The salt marshes were similarly affected; layers of salt in salt-pans or marsh-beds on the Townsville Town Common were seen to take the place of salt marshes. In the face of these conditions, the present survey afforded excellent opportunities for investigating into the ravages of the strictly household breeding species of mosquitoes. At a time when the rural species (which are wholly or greatly dependent upon climatic conditions) are reduced to negligible quantities, the prevalence of the domestic species has remained more or less unaltered, both over the winter months and over a protracted spell of dry weather. This is where household conservation of rain-water becomes an interesting factor in the prevalence of domestic mosquitoes. On the other hand, tanks are not solely responsible for domestic species of mosquitoes; by leaving one's jardiniéres untouched for a week, one may invariably (both throughout the winter and the summer months in Townsville) secure fully-grown larvæ of *Aëdes ægypti*, and it has frequently been observed that, where other water-containers are absent, a water-holding jardiniére has been responsible for bringing forth a sufficient number of individuals of the species in question to plague a household to the limits of despair. Many premises which were visited were pestered by none other species than *A. ægypti*, and from many personal observations one is convinced that this species principally, and also

Culex quinquefasciatus, are the two most objectionable mosquitoes of household origin in Townsville. It is true that over other (and more favorable) periods, the town suffers the depredations of the migrant salt-marsh mosquito *Aëdes* (*Ochlerotatus*) *vigilax*, but it is quite noteworthy that imagines of this species were not seen throughout the inquiry, although the temperature was very favorable, but the necessary factor (marshes) was absent; however, several weeks after the close of the inquiry (and after abundant rains had fallen on salt marsh-beds) the town suffered a few invasions of *Aëdes vigilax*. The accompanying rain-graphs illustrate the effect of withheld rains on the



TOWNSVILLE RAIN GRAPHS.

a. Showing the figures for the year 1923 and part of 1924. (This graph is plotted from figures supplied by the Commonwealth Meteorological Bureau.)

b. Showing the average monthly distribution of rainfall, based on mean monthly readings over a period of 42 years; the curve is plotted from figures secured from the *Results of Rainfall Observations made in Queensland*, Melbourne, 1914, p. 221.

prevalence of *A. vigilax;* for about three-quarters of the year of 1923 there was not a specimen to be found, but when the small amount of December rain fell, and for the next four months (1924) of more or less rainy weather, *A. vigilax* was very numerous, whereas in the corresponding months of the previous year not one specimen was to be observed. These phenomena are indeed quite natural, and apply to several other places in Australia where, time after time, withheld rains means the suspended breeding of *A. vigilax.*

The mere fact alone that *A. ægypti* is seen in drought or rainy periods is sufficient to proclaim its extreme domesticity. Out of 1,000 house visitations made, there were only 428 rain-water tanks (42.8 per cent.) observed. Of these, eleven (2.57 per cent.) were effectively screened against mosquitoes, and in 58 cases vain endeavours had been made at screening. Of the 417 unscreened tanks, 189* were seen to contain mosquito larvæ, 186 of which contained larvæ of *Aëdes ægypti*, five contained larvæ of *Culex quinquefasciatus*, and one those of *Lutzia halifaxi.*

Several water-holding cavities in the boles of trees were noticed to contain larvæ of *Aëdes notoscriptus* and *Aëdes ægypti.*

It is generally customary to screen only the manhole, without taking thought of the overflow or any holes (sometimes large and gaping) which may be in the sides of the tanks. There is a false notion which

* No time was spent in endeavouring to secure larvae from tanks if the larvae were not drawn off through the tap in a couple of basins of water. It may be reasonably concluded that all unprotected tanks in tropical Australia act as breeding places for *A. ægypti.*

appears to be dominant in the minds of many (plumbers included) that so long as water is strained on its entrance into the tank through the gauze on the manhole screen, the requirements in anti-mosquito work are attained. Hence the reason why overflow pipes and other holes in the tank are so often neglected. Moreover, it is also wrongly thought that so long as an overflow pipe has an elbow or two in its length, and especially if the pipe is a long one, screening need not be done.

Anopheline mosquitoes are not seen, except in the larval stage, whence by collecting the larvæ and separating them from their natural enemies (dragon fly larvæ, Notoneotidæ and larval Dytiscidæ) one was able to rear adults of *Anopheles annulipes* (including the "variety" *amictus* of Edwards) under laboratory conditions; its larvæ, however, had to be collected one by one, and oftentimes the collection was very slow work. Under laboratory conditions the Dytiscid larvæ disposed of a fair number of mosquito larvæ in the course of a day. It is probably true that only a small percentage of Anopheline mosquito larvæ hatches from the fresh waters on account of the natural enemies with which the water is stocked. On the other hand, it is equally true that these enemies (Notonectidæ and Dytiscidæ) could never be solely relied upon in the practical application of anti-mosquito work on these lines.

Several species of fish were noticed in the limited number of permanent waters, amongst which are—

Melanotænia nigrans (Richardson, 1843) ("Crimson-spotted sun-fish");
Carassiops galii Ogilby, 1898 ("Fire-tailed gudgeon");
Carassiops compressus (Krefft, 1864) ("Carp gudgeon");
Craterocephalus stercus-muscarum (Günther, 1867);
Therapon percoides Günther;
Ambassis agrammus Günther.

The two first mentioned species are well known mosquito-larvivorous fishes. Information is yet to be acquired in respect of the larvivorous proclivities of *Ambassis agrammus*. In respect of *T. percoides* and *C. stercus-muscarum* information is also wanting, but it might be stated that as these species grow to an undesirably large size for use in anti-mosquito work, they are probably of no practical value.

Résumé and Conclusions.

The whole condition of mosquito breeding in Townsville during the period under observation may be briefly stated to have depended upon domestic (household) water collections and other artificial breeding grounds, such as a few collections of sewage. Except for *Aëdes (Finlaya) notoscriptus*, domestic mosquitoes were observed to the entire exclusion of other species. These domestic species of mosquitoes are, in order of frequency, *Aëdes (Stegomyia) ægyptus* and *Culex quinquefasciatus*.

These household mosquitoes require for their breeding-places tanks, water-barrels, disused horse-troughs, roof gutters, jardinières, butter-coolers, bedroom water-jugs, ant-traps insulating the legs of safes, and so on.

Stagnant sewage offers a very favorable breeding-place for *C. 5-fasciatus*. The water-seals of acetylene gas generators constitute very favorable breeding-places for this species.

A. ægyptus is active indoors in Townsville, especially during the daytime, and to a certain extent at night. The use of mosquito nets appears to be mainly against this species, and also against *C. 5-fasciatus*.

The breeding of these two species is continued throughout the mild winter months, and these mosquitoes are rendered independent of weather conditions by all the facilities afforded by a life of domestication in the way of utilizing tanks and the minor water collections both indoors and out of doors.

Aëdes vigilax (the Salt-marsh Mosquito) being dependent upon tidal and weather conditions, was not observed throughout the period of inquiry. Neither were adult Anophelines observed. Regarding these species as having been extremely scarce or absent from dwellings during the period under discussion, it may be definitely asserted that any annoyance caused over this period was the result of infestation by domestic species of mosquitoes, and these alone. Being very limited in their range of flight—especially *Aëdes ægyptus*—there is every justification for the statement that whenever adults of *A. ægyptus* (and generally of *C. 5-fasciatus*) are found in a household in Townsville, their larvæ must be sought near at hand, indoors or out of doors, on those premises or on the ones in immediate contiguity. In the wet season, however, annoyance arises at the drain-outfalls of houses—generally in quagmires of sewage on footpaths or in unformed street water-channels, especially in low-lying and waterlogged areas.

In favorable seasons, the town from time to time suffers greater or lesser swarm invasions of *A. vigilax*, as well as other rural species. The ordinary range of flight under these conditions would be, on the average, 3 miles from the stagnant salt marshes lodging especially on the Town Common. There is, of course, other evidence in Queensland that *A. vigilax* will travel ordinarily from 5 to 10 miles, and probably 20 miles or even 40 miles.

Anophelines may sometimes enter houses, especially if the latter are situated in close proximity to breeding-places, but generally speaking the depredations of aquatic insects (Notonectidæ and larval Dytiscidæ) and fish answer, in great measure, for the scarcity.

Melanotaenia nigrans ("Crimson-spotted sun-fish") and *Carassiops galii* ("Fire-tailed gudgeon"), amongst other fish, are inhabitants of the permanent fresh waters, such as the impounding reservoir and the smaller waters. Local tests with the former named fish still rank this species as a very powerful larvae destroyer. Needless to say, the places from which these fish were collected contained no mosquito larvæ.

Measures for dealing with the mosquito nuisance in Townsville are more or less obvious, according to the species which it is determined to allay. These suggestions are withheld here mainly on account of brevity, and, secondly, because they have already been made known to the local authorities concerned.

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Industrial Hygiene in Confectionery.

By Dr. W. CRESWELL HOWLE, Medical Officer to "Sweetacres," Sydney.

WHEN Messrs. James Stedman-Hendersons Sweets Limited, of "Sweetacres," Rosebery, Sydney, decided to install a medical service into their plant, they did so for the following, among other reasons:—

Their community of workers bordered upon 1,000.

They recognized the obligation of employer to employed in the matter of health and well-being.

They wished to attract and retain healthy and satisfied workers.

They thought that where many women and girls are employed, a trained nurse in constant attendance would be an advantage both to them and the employees.

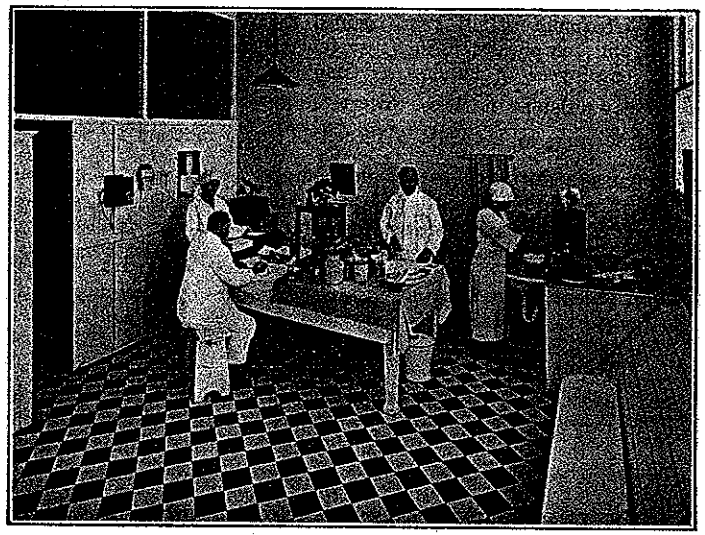
They thought that many slight cases of accident and illness could be attended "on the job," and so save suffering and lost time.

They hoped that such a service would eliminate friction in reference to claims.

They imagined that it would conduce to a continuance of good feeling between them, and those working with them.

They thought, in short, that it would be "good business."

Sweetacres is an institution occupying 14 acres, on 7 acres of which stands the plant, and the remaining 7 acres is laid out as drives, playing grounds for cricket or football, with part arranged for tennis and other games. Gardens are arranged upon three sides. Adjacent is the garden suburb of Rosebery. The building was modelled upon modern lines, being designed for its present purpose, and built in 1916, with lighting, ventilation, and all appointments of the latest approved type.



A CORNER OF THE SURGERY AT SWEETACRES.

Approximately 1,000 persons are employed, men and women, in about the proportion of three to five. Manufacturing confectionery includes many more trades than sugar boilers, and there are employed engineers, carpenters, printers, boxmakers, painters, cleaners, packers, transport workers, motor drivers, firemen, toolmakers, electricians, clerks, typists, designers, artists, foremen, and forewomen.

Part of the factory is set apart for the "medical ward." It is fitted as surgery, rest rooms, waiting room, and dental clinic. A trained nurse is engaged during the whole working hours, and a medical man and dentist part time. The duties of the medical department are roughly outlined as follows:—

The examination of candidates for employment, or, as Mr. T. Poole, the superintendent, whose ideals pervade the establishment, prefers to call it, entrance examination to the community of