

mean a good deal of expense or hardship for the time being. I have had a little experience in educating the public—children and adults—and while I agree heartily with Dr. Hurty on the importance of educating the children I believe also in educating the adult. In New York, thanks to the efforts of Dr. Herman M. Biggs, we have educated the people, and the result has been a reduction of the mortality of tuberculosis of well nigh 40 per cent. That means a good deal. We are also trying to educate the children; we are getting out a catechism on tuberculosis, and we try to educate teachers in the schools. A few practical things are not taught or not taught often enough, which should be mentioned again and again. Grip, tuberculosis and pneumonia, I firmly believe are propagated just as frequently through drop infection as by any other means. I mean by “drop infection” the expulsion of micro-organisms through the so-called “dry cough.” There is no such thing as a “dry cough.” A mirror held before the mouth will reveal that droplets are expelled during the cough. These droplets may contain the bacilli. So one of the first things to teach people who cough, no matter where, is always to hold the hand or handkerchief before the mouth. I am an enthusiast in all things pertaining to bacteriology, serums and vaccines, but we must still always pay attention to overcoming the physiologic poverty of our school children. Teach children to be clean, to breathe deeply often and to love fresh pure air. Tell them to teach this love for cleanliness and fresh air to their parents. I believe we should have no public school without shower baths and a swimming tank. It was my sad experience as attending physician to North Brothers Island to witness, on the day of the Slocum disaster, 400 little bodies taken from the water only a short distance from our island. Three-fourths of these children were drowned because they did not know how to swim. Is it not as important to teach swimming to our boys and girls in the public schools as to the pupils in high schools and colleges?

COL. WILLIAM C. GORGAS, Ancon, Canal Zone: My experience with transmissible diseases, principally in the last fifteen years, teaches me to look on the sick man as the great transmitter of diseases from place to place. We can see now that it would be impossible for fomites to play much part. My ideas on this subject have been much affected by the radical way in which my views have been changed with regard to malaria and yellow fever. Fifteen years ago there was nothing more certain than that yellow fever was a disease transmitted principally by fomites. I had been educated in that belief, and had worked under that idea. About this time other mosquito-borne diseases were being discussed. I was thrown a great deal with Dr. Finlay, who had been maintaining the theory that yellow fever was transmitted by the mosquito. He then defended his position entirely by argument, but by most ingenious and plausible arguments based on the facts then known connected with the disease. I think, in general, that men who have worked a great deal in health matters, have charge of quarantinable diseases and have been accustomed to executive work, are inclined to be intolerant and to look on the accepted view as the only possible thing. This was our case. Dr. Carter and I were for two or three years with Dr. Finlay on a board whose duties it was to see all cases of yellow fever reported in Havana. I am afraid that we were rather inclined to be short with Dr. Finlay and to treat his idea with scant respect. From our plane of superior knowledge we were much inclined to pull his theory to pieces in a very unmerciful manner. After seeing the experiments on human beings, however, I was obliged at once to accept the theory that yellow fever could be transmitted by the mosquito, and after that I was rapidly forced to believe that, in nature, it was transmitted only in this way. I then had, of course, to drop all belief in the possibility of its transmission through fomites. This radical change in belief naturally made a strong impression on me. As time has gone on I have endeavored to follow up this subject, and I now believe that yellow fever is transmitted only by a sick person going into a community and infecting mosquitoes locally. The only other way of transmitting the disease from place to place would be by carrying infected mosquitoes from one place to another. Infected mosquitoes can be brought from one place to another

in a test-tube, or a ship can get infected mosquitoes aboard at one port and carry them to another port, but I believe that actually this is very rare. This experience has affected my views with regard to malaria and other infectious diseases, and I am inclined now to look on the sick person as being the principal means of the transmission of these diseases and to believe that fomites play a very small part in the matter.

DR. DAVID L. EDSALL, Philadelphia: I am much surprised to hear Drs. Egbert and Hurty speak as they did. The education of children is an extremely valuable and important measure, but not a perfect method. One reason is that much of the teaching of physiology and hygiene in the public school is very silly. Teachers must be educated before they can teach children properly. In the second place, a child forgets later on much that he learned in school and needs reiterated instruction throughout his whole early adult life in order to keep him in the right way. I think that we can do a great deal with the adults. The health officers and hygienists are at a considerable disadvantage in dealing with adults, whereas the general practitioner deals with them personally and can accomplish a great deal with many persons, though not with the most ignorant and obstinate. Many can be reached through altruism. We should as far as possible prevent communication with typhoid patients in order to limit the number of infection carriers whom we can't get at.

DR. M. J. ROSENAU, Washington, D. C.: In no sense do I underestimate the importance of obeying the laws of health, of improving the bodily tone and strengthening the vital forces, which are among our chief allies in the battle against infection. Certainly, my conclusions can not be understood as a plea to disregard the aggressive measures which sanitarians must use in their fight against the communicable diseases, and by no means can they be misunderstood as an excuse for carelessness. I fully appreciate the great importance and value of educating the public in public health matters. These matters were not mentioned specifically in my short paper, but that does not mean that I think they should be neglected. I confined myself simply to one single thought, and that is that as a rule it requires a certain amount of infection to produce disease. Tuberculosis should not be taken as an example to illustrate this point, for the reason that the balance between tubercle infection and health is so delicately adjusted that a slight lowering of the vital forces is frequently sufficient to be the determining factor; but in a large majority of diseases, such as measles, smallpox, whooping cough, scarlet fever, yellow fever and many others, an individual may fall victim to the infection, no matter how great his bodily vigor may be, I simply endeavored to make plain certain facts well known in bacteriology. These facts explain certain phenomena frequently observed by sanitarians. The lesson to be drawn is that, by adopting reasonable sanitary standards, we can save life and prevent much sickness while we are waiting for the millenium. There can be no conflict between the admirable views set forth in Dr. Edsall's paper and what I have said in regard to the relation of the amount of infection to reasonable sanitary standards.

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### *Clinical Notes*

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#### PRACTICAL MICROMETRY IN THE CLINICAL LABORATORY

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While the medical student of to-day is made thoroughly familiar with the appearance of every microscopic structure, animal, vegetable or mineral, which is of practical importance to him either from the standpoint of diagnosis or otherwise, he is apt to have very little capability to appreciate microscopic magnitudes. We train him to search for various organized structures and to discriminate between objects which are character-

istic of some diseased condition and unimportant objects, such as extraneous matter and artifacts, but we teach him very little of the size and nothing of the determination of the size of these microscopic structures. The result of this condition of affairs is seen in the case of objects which differ in size, but resemble each other to a certain extent in shape and general appearance. One is sometimes asked to confirm a diagnosis of *Strongyloides stercoralis* or some other intestinal parasite when the vegetable cells which have been mistaken for entozoan eggs are larger than any fluke-worm egg. Even an approximate determination of size would prevent such mistakes as this.

I have endeavored to devise a means of microscopic measurement which shall be simple, convenient, inexpensive and as accurate as is necessary for the present purpose, with the hope that it will be a definite help to the medical student in a direction in which aid is needed but is difficult to obtain.

The most accurate methods of micrometry, such as the photomicrographic method and the use of a screw micrometer eye-piece, are out of the question here, as is also the use of the camera lucida. The eye-piece micrometer with a fixed scale allows accurate measurements after being calibrated for the microscope, draw-tube reading, nose-piece and objective used, and ought to be a more popular accessory than it is at present. It could be supplied in medical schools along with the microscope which is furnished for the student's use, and would increase the amount invested in the outfit by only about 5 per cent. It does not need to be alternated with an ordinary eye-piece, but may be left permanently in the microscope, as the eye soon learns to ignore the scale when not in use as easily as it overlooks stray air-bubbles in the preparation examined.

A method which requires no additional attachments is the use of an ordinary graduated ruler laid on the table and viewed with one eye while the other observes the microscopic image. The two fields of vision are mentally superimposed, the ruler apparently lying across the image of the object. A scale with the different inches divided into sixths, eighths, tenths, twelfths, sixteenths and twentieths is said to be very convenient.<sup>1</sup> A previous calibration of the ruler by comparison with a stage micrometer, a microscopic scale of hundredths of a millimeter; or a knowledge of the magnifying power of the optical combination used is all that is necessary for making measurements. Aside from the difficulty in placing the ruler close enough to the optical axis of the microscope, however, many persons also find it difficult to keep the convergence of the eyes constant under such conditions, the result being that the two fields of vision shift laterally across each other in an irregular manner.

The method of micrometry which I propose consists essentially in the addition to the microscopic preparation of some insoluble substance which occurs in particles of comparatively uniform dimensions and of suitable size, a width of 25 to 50 microns being preferable for general use.

A large number of objects which suggest themselves for this purpose prove to be unsuitable when tried. Cotton fibers are always at hand, but vary too much in diameter. Starch grains are easily procured and by selecting the variety of starch any one of a considerable

range of sizes may be obtained. Unfortunately, the different grains of any given kind of starch show decided variations in diameter. Many objects, such as tapeworm eggs, are of very uniform size, but either are difficult to procure in sufficient quantities or are substances likely to be present in the microscopic preparations examined. A suitable substance must be one which can always be recognized as something extraneous. Yeast cells, lepidoptera scales, molds, diatoms, confervæ, etc., must be rejected for similar reasons.

Two substances which appear more promising are the pharmacopeial lupulin and lycopodium. Each has grains of about the right size, and a perfectly characteristic appearance which could not possibly be mistaken for anything else. Lupulin grains vary in both size and shape after being kept for some time, but the lycopodium grains do not seem to deteriorate on keeping. They are practically uniform in size and are roughly spherical with a tendency to a four-sided flattening into a rounded tetrahedron. The material may be obtained from any drug store and is not apt to be adulterated with other substances. In examining a considerable number of specimens purchased in different localities, I have never seen a grain of pine pollen or any other foreign matter.

In order to obtain a quantitative determination of the variation in size of lycopodium granules, measurements were made, using an eye-piece micrometer, both of different specimens of lycopodium as purchased, and of the same specimen after being kept under different conditions. The figures given here are the last six sets of a series of measurements and represent three different samples, one of them as purchased, the same after being exposed to the air in a thin layer for four months, and after being carried in the pocket in a capsule for four months and for eight months.

32.8 plus or minus	.18 micromillimeters.
33.5 plus or minus	.21 micromillimeters.
33.6 plus or minus	.21 micromillimeters.
32.9 plus or minus	.22 micromillimeters.
32.8 plus or minus	.23 micromillimeters.
33.4 plus or minus	.27 micromillimeters.

The first number in each case is the average of twenty-five measurements of lycopodium grains spread on a glass slide by the method explained below and chosen in such a manner as to avoid any source of "systematic error" which might produce misleading results. The number following the plus-minus sign is the quantity which is known by the rather misleading name of the "probable error," and represents limits in excess and in defect of the average which have been so taken that the probability of another determination falling between these limits is just equal to the probability of its falling beyond them. It indicates the way the individual measurements "scatter" or cluster around the average. The figures given are maximum diameters of a maximum optical section of the lycopodium grain. This is usually from one of the apices of the tetrahedron to the middle of the opposite convex surface. While they undoubtedly show that the variations under different conditions are the result not merely of accidental variations, but of true differences in the size of the grains, they also show that for the present purpose the diameter of the lycopodium grain may be considered as being uniformly one-thirtieth of a millimeter or thirty microns. A few grains are sometimes seen which are perceptibly larger or smaller than the majority, but these are relatively infrequent and are easily detected when several grains are seen in the same field.

1. Hayden, Thomas: A Short Notice of a Ready and Simple Mode of Measuring Microscopic Objects, Dublin Quart. Jour. Med. Sc., 1855, xix, 119.

For practical use a few grains are scattered over the preparation to be examined, and any object of interest is compared with a lycopodium grain in its vicinity, an object half as wide measuring 15 microns, one twice as wide, 60 microns, etc. With a little practice one can easily determine whether an object is, for example, nearer 20 microns than 25 microns, or *vice versa*. The lycopodium grains are not always wetted with aqueous fluid, so that in the preparation they are sometimes seen surrounded by a layer of air, but the inconvenience of moistening them with alcohol or otherwise and keeping them in some fluid is not counterbalanced by the slight advantage of having them free from air bubbles.

The dry lycopodium is conveniently kept in a hard gelatin capsule, which is easily carried in the pocket so as to be always at hand when needed. The size known as the Number 1 or five-grain capsule is large enough to be handled without difficulty and not so large as to be liable to accidental crushing. If each capsule is filled about one-third full a hundred capsules will require only two or three drams of lycopodium and the cost of both is negligible.

In furnishing these capsules to a class of students in clinical microscopy, it will be necessary to give a few directions as to the best method of using them. Any attempt at pouring or shaking out a little lycopodium will not only use up an unnecessarily large amount of the material, but will deposit the grains in large, opaque masses in a very irregular manner. The "cap" of the gelatin capsule should be removed and its edge scraped against the edge of the other half of the capsule as they are held just over the microscopic preparation. In this way the thin layer of lycopodium adhering to the inner surface of the cap is shaken out as a fine dust-cloud which does not settle rapidly, but by gentle blowing may be easily sent against the moist preparation and distributed very uniformly over it.

The results of this method of making measurements are very striking. Students who have previously been unable to give even an approximate estimate of the size of an ordinary tube-cast, an echinococcus hooklet, a tapeworm egg, etc., quickly acquire a definite conception of the magnitude of such objects, and it is a very different kind of knowledge from that which results from the mere memorizing of a row of figures.

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## MUSTARD PACKS IN TREATMENT OF CAPILLARY BRONCHITIS IN CHILDREN

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Mustard has been in use as a counter-irritant for many centuries, but it is astonishing how few physicians are acquainted with its excellent properties as a counter-irritant in the treatment of capillary bronchitis and bronchopneumonia in infants and children.

Most doctors content themselves with the use of some patented, odoriferous kaolin or clay paste. These patented pastes have many disadvantages. In the first place, they hinder by their weight free respiratory movement; second, their action is entirely insufficient; third, they may cause a severe dermatitis by blocking up the openings of the sebaceous glands. I am acquainted with one case in which an erysipelas was directly traced to the application of one of these patented pastes.

The value of counter-irritants in the treatment of capillary bronchitis in children has been amply demonstrated. Mustard is one of the simplest and most active of counter-irritants and one to whose efficacy in this condition there is ample testimony. It is especially indicated when such dangerous symptoms as severe dyspnea, asphyxia, cyanosis and great general prostration arise. Up to the present time, when used for this purpose, it has been mostly applied in the form of a paste or a mustard water (Heubner). For the past thirteen years I have been using a method of my own device. Both my colleagues and myself are so convinced of its undoubted efficacy, and the method possesses so many advantages over other methods of counter-irritation, that I feel constrained to publish this method here.

Two hundred and fifty c.c. (half a pint) of water and 250 c.c. of alcohol are mixed in a large bowl; to this is added from 25 to 50 c.c. (1 to 2 fluidounces), depending on the severity of the case, of freshly-prepared spirit of mustard. The spirit of mustard is prepared according to the German Pharmacopeia (the volatile oil is the active principle of mustard):

Oil of mustard.....	1 part
Pure alcohol .....	49 parts

A large piece of flannel is well moistened with the mixture and the body of the child wrapped up from the neck to the knees. This moistened flannel is then enveloped in a dry sheet and the child is left in this pack until the skin is bright red, which point is usually reached at the end of fifteen to thirty minutes. The child is then taken out and wrapped and left for another half-hour in a pack moistened with a mixture containing one part of alcohol and two parts of water. At the end of this time the child is wrapped up in a dry sheet. In most cases one well-applied mustard pack will suffice to bring about a permanent improvement. Relapses, however, are of frequent occurrence, whereupon packs are renewed. It is not advisable to apply the pack more than once in twenty-four hours unless the indication is unavoidable. It is advisable that the physician apply the first pack himself, not only to determine the strength to be applied, but also for purposes of instruction to the parents or nurses. The effects of this mustard pack on the child are truly striking. The cyanosis disappears promptly, the dyspnea is relieved, the pulse improves considerably and the mental condition of the patient is notably brighter. The transition from a state bordering on collapse and one which in some instances may even be termed moribund, to a condition in which the clinical picture becomes immediately more roseate, is not, I venture to say, effected so rapidly and satisfactorily by any other therapeutic weapon at our command. Heubner of Berlin explained the beneficial effect of the application of mustard in these severe cases of capillary bronchitis as follows:

The lungs of children who have capillary bronchitis and bronchopneumonia show a very pronounced hyperemia and a dilatation of the blood vessels in the walls of the bronchi. The bronchial tubes themselves are entirely stopped up with secretion. The skin of these patients presents an extreme pallor. The hyperemia of the respiratory tract may be termed an inflammatory stasis of the blood in the lungs. The hyperemia caused by the counter-irritation of the mustard on the skin, therefore, opens up a new territory for the circulation of