	Names of drugs and their dilutions with 2% blood-solution.	Elevations of tracings in millimeters.
IX.	Aconitine, 1: 160,000	16
	Curare, 1: 26	5
	Effects of their combined action,	15
X.	Atropine, 1: 160,000	15
	Strychnine, 1: 1,000	4
	Effects of their combined action,	14
XI.	Strychnine, 1: 160,000	17
	Atropine, 1: 1,000	4
	Effects of their combined action,	15

Several things are made very clear by the preceding considerations. One is, that drugs expend their forces directly on the bodily textures, and not on any hypothetical intervening medium. Another is, that small or minimum doses enhance bodily resistance, and that large or maximum doses depress or paralyze the same. And still another is, that minimum doses successfully antagonize the disintegrating effects of maximum doses. These antagonistic effects are displayed here as decidedly as if they had been wrought by the two mechanical forces of attraction and repulsion, and they give us an exact mathematical demonstration of the power which drugs have of supporting and preserving life when attacked by adverse forces. Now, if we recognize the fact that disease is but the manifestation of forces which move in a direction adversely to health, and substitute these for the operation of the maximum drug doses in the above illustrations, do we not have a clear picture before us, as to how a large class of drugs in minimum doses combat disease, *viz.*, by stimulation? On the other hand, is it not equally clear how maximum doses possess the property of depressing hyperactivity of the bodily textures — a pathologic condition which lies at the bottom of many important diseases — and thus give us at least a fundamental idea of the action of two other large classes of drugs, *viz.*, antiseptics and antipyretics?

DIAGNOSIS AND TREATMENT OF DIPHTHERIA IN YOUNG CHILDREN.*

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This paper is not intended to be a complete consideration of the diagnosis and treatment of diphtheria in young children. It deals with diagnosis particularly in young children, because it is among them that most cases occur, and more especially because the younger the child, the higher the mortality and the greater the urgency of diagnosis and treatment. Moreover, since the general use of antitoxin, the mortality in the very young has not been reduced proportionately to that in older patients.

In making a diagnosis of diphtheria, we have two methods: the bacteriological and the clinical.

The bacteriological method is subdivided into immediate examination of smears and late examination of cultures.

Diagnosis by smears is unreliable, as when

smears show no bacilli, bacilli may be shown by culture. By a smear you can only note the presence or absence of bacilli, like the Klebs-Löffler. However, this direct method is suggestive or corroborative when positive, but when negative should be disregarded entirely.

The examination of cultures is the most certain method we have of diagnosing diphtheria. But is this as valuable a method for purposes of treatment as the clinical diagnosis?

In recent years laboratory diagnosis has properly acquired a high position in the minds of most physicians, but I believe, in the estimation of many, its position is too exalted. I have had sufficient experience in the midst of laboratory diagnosis to know that it has some fallacies. Aside from the possibility of error, bacteriological diagnosis must use up valuable time; in the case of diphtheria, probably, twelve hours or more. Can we afford this time for purposes of treatment?

Clinically, by certain symptoms and signs familiar to us, we can usually recognize a probable case of diphtheria. There is quite a possibility of mistake; still, bacteriological examinations have generally shown earlier clinical diagnoses to have been correct.

I believe that textbooks in their discussion of diphtheria mislead. They follow the old rule of etiology, pathology, symptomatology, diagnosis, prognosis and treatment, particularly, treatment follows diagnosis. For diagnosis they teach you to rely upon cultures. Here, it seems to me, is a disease in which, especially in young children, treatment should come first upon suspicion. Then positive diagnosis should follow for purposes of quarantine. In the hands of the general practitioner, the reliance upon culture examinations has a damaging effect upon treatment. A physician may be reluctant to make a diagnosis of diphtheria. He may feel that he is working in the interest of his patient, or the family of the patient, to avoid quarantine if possible; to wait for the report of the culture, hoping that it may be negative. He feels justified in such delay because he follows the instruction of the books. He knows that laboratory diagnosis is the surer diagnosis. He knows that his two best diagnostic aids are, first, the report of the culture; second, the spread of the membrane.

In medicine it is good to feel certain; perhaps in a dozen hours one can read, "Diphtheria bacilli found," or can note the visible spread of membrane, although the invisible spread of toxins has been vaster. One then has diagnostic security; the child has less chance of recovery. I believe that the proportionately high mortality of diphtheria in young children is due in part to reluctance to call certain suspicious cases diphtheria and to institute quarantine. An older patient can naturally better tolerate such delay.

We, as practitioners, want the earliest possible diagnosis, because the cases treated earliest have given much the best results. Then, too, isolation and immunization are more certainly accomplished.

Diphtheria antitoxin has been shown to be

* Read to the Portland Medical Club, June 6, 1907.

harmless, and may be beneficial to patients without diphtheria, *e. g.*, in tonsillitis and in scarlet fever. We shall then do no harm in giving antitoxin to a child without diphtheria. It must appear to us that lives have been lost by waiting for more diagnostic evidence, and that lives have not been lost through giving antitoxin on suspicion. If so, for purposes of treatment, which implies prompt treatment, the clinical diagnosis must be the best. Its only possible faults are that we may unnecessarily disturb families and deprive them temporarily of their freedom. Such failings seem trivial when contrasted with the fact that we must otherwise sacrifice lives.

I shall depart from this debate to mention a few cases and a few facts which I think of relevant interest. Pediatricists call attention to the great importance of the examination of the throats of all sick children. Failure in this I know has harmed patients and physicians.

I recall a case of a two-weeks-old baby whose only symptom noticed by its mother was that it would not nurse. Much to my surprise its throat showed advanced diphtheria.

In cases of doubtful diagnosis repeated throat examinations should be made. Young children, sick with diphtheria, may show no evidence of membrane formation for several days. Last winter I watched a fifteen-months-old baby for several days unable to make a diagnosis. The only symptoms were moderate fever, apathy, anorexia and occasional vomiting. The physical examination was negative until on the third day a membranous exudate appeared upon one tonsil and proved to be diphtheritic.

That very young children rarely have follicular tonsillitis should be borne in mind. Recently I noticed the statement of a German physician, Seibert, that in very young children, a probable diagnosis of diphtheria should be made upon slight evidence. It brought into my memory a patient I saw a year ago, a child two and one-half years old, sick about twelve hours with moderate fever and lassitude. On examination one tonsil showed two small patches no larger than those ordinarily seen in follicular tonsillitis, but the unilateral position and especially the age of the patient made me suspicious enough to give 3,000 units of antitoxin. The patches had nearly disappeared the next day, by the time I had found bacilli in a culture. I have seen several similar cases, which makes me believe that they are not uncommon.

My conclusions in diagnosis are that in young children, a probable diagnosis of diphtheria should be made upon comparatively slight evidence; that the dangers of waiting are so great that a clinical diagnosis is of first importance and all sufficient for the purpose of treatment; and that cultures are of value mostly for purposes of immunization and quarantine.

In larger cities where the mortality of diphtheria was from 35% to 50% without antitoxin, it is now less than 10%. Cases treated the first day show a very low death-rate, *e. g.*, in the Boston City Hospital, 180 doctors and nurses

had diphtheria without a fatal result. In young children the urgency of early treatment is naturally greater. It is a fact that in early life the mortality of diphtheria with antitoxin has not been proportionately diminished. Under two years of age the mortality is still about 30% in recognized cases.

This higher death-rate in early life is attributed to a greater susceptibility to the toxins and to the greater frequency of pulmonary complications.

It seems to me that diphtheria in an infant should be entirely amenable to a specific treatment that is given early enough. I believe the higher mortality is at least in part due to such reasons as failure in the routine examination of throats, the reliance upon cultures, *i. e.*, the failure to make a diagnosis without delay, and the use of too small doses of antitoxin.

The kind of antitoxin employed is of importance, and I believe that only the newer concentrated forms of antitoxin, of which Lederle's is a type, should be used. Concentrated antitoxin is much more easily injected, — a fact of great value in treating children. It encourages the use of larger doses, and the untoward effects of the horse-serum are less.

I do not intend to go into detail of dosage, but will mention my opinion, that in young children the initial dose should average 3,000 to 4,000 units rather than less, because recovery is quicker and it is less often necessary to repeat the injection, and because, appreciating the harmless character of antitoxin, it is better to give too large rather than an insufficient dose.

In a general way it may be stated that the dose of antitoxin is not dependent upon age, but upon the apparent severity of the disease and its duration when discovered.

One should remember that a nursing mother, sick with diphtheria, excretes antitoxin in her milk. Last fall I had such a patient with a suckling one month old. The mother had a severe form of tonsillar diphtheria. Her boy, six years old, developed diphtheria within twenty-four hours; but the baby nursed at the mother's breast and remained well. This supposition of antitoxin in the breast-milk may be incorrect or only a partial explanation. Recently S. Amberg found that all well nourished young infants have a high opsonic content of the blood; that the value of the opsonic content is in proportion to the nutrition of the infant; that breast-fed infants resist disease better because they are generally better nourished.

The Immediate Prophylaxis of Diphtheria.

This is generally considered to mean the administration of an immunizing dose of antitoxin to all exposed; but it should mean more. A physician showing a proper regard for other children, either wears a special hat and gown in attendance, afterward thoroughly cleanses the exposed portions of his person, or the equivalent of these, or else gives an immunizing dose of antitoxin to all other children whom he attends

at the same time. There is no doubt about the possibility of carrying the disease in the clothes. Most physicians are willing to take the time for good surgical technic, but I believe many are not willing to take the time for good medical technic, of which this is a good example.

Quarantine.—In Portland, all patients receiving board of health antitoxin treatment are quarantined three weeks. Of course all cases of diphtheria should be quarantined, but I do not believe that all who receive antitoxin treatment should be long quarantined; for example, if in a suspected case antitoxin is given as a safeguard, and if by cultures the case proves not to be diphtheria, I think quarantine should cease. A careful board of health may reply that some physicians would fake cultures, that all cases of diphtheria would not be kept in quarantine. On the other side there is the fact that doctors, at times disliking to quarantine unnecessarily, will, to be more certain of diagnosis, let a mild case advance; and so while the use of board of health antitoxin compels quarantine, lives of patients will perhaps unconsciously be risked. I know of a case of a child three years old, living in a boarding house, which one would not like to quarantine unnecessarily. The diagnosis of diphtheria being uncertain a bacteriological examination was awaited. The bacteriological report was positive and twenty-four hours later the child died.

I believe really that such delays are faults of physicians and not faults of board of health rules; and, finally, that it is surely better to quarantine a number of families needlessly than to lose one patient through fear of it.

A SIMPLE METHOD OF RECONSTRUCTING NERVE PLEXUSES.

BY R. M. SMITH, M.D., AND E. W. TAYLOR, M.D., BOSTON.

A COMMON difficulty in the study of anatomy is the visualizing of relations. This is particularly true of the nervous system. However elaborate diagrams and plates may be, they fail to impress the important spatial relations of various structures. Dissection naturally comes to one's rescue in this respect, but even here the natural difficulties of continuing work in the dissecting room, after the early student years, are practically prohibitive. Any simpler resource, therefore, which will tend to impress upon the mind the relationship of correlated parts is of value, not only in teaching anatomy, but also in learning it. Hence have arisen various methods of more graphic representation than even the best illustrations can supply. Clay modeling, for example, has long been used with great success in the reconstruction of internal organs and, to some degree, in the study of the nervous system. Herring¹ describes in a convincing way the value of clay modeling as applied to the nervous system, and the extraordinary work of Florence

R. Sabin in reconstructing the oblongata is well known to all students of the subject.

Perhaps the most elaborate attempt of this sort in teaching the finer anatomy of the central nervous system is described by Hardesty,² of the University of California. In a paper entitled, "A Class Model of the Spinal Cord," Hardesty describes in great detail a method of tracing the course of fibers in the spinal cord and lower oblongata by graphic methods. His plan is to make several cross sections of the spinal cord by means of wax plate models, accurately outlined from actual specimens. Stout wire is then used to connect the levels and to represent the various fiber tracts which may be easily distinguished by painting in different colors. By these means it is possible to build up in very considerable detail the essential internal structure of portions of the nervous system. In fact, the method has proved so practicable in Hardesty's hands that the students are expected personally to make such models as part of their training in the anatomy of the nervous system. It need hardly be said that the details which such a model brings out are not to be obtained through dissection, nor through the study of sections by the microscope, and yet these are the important points and far overbalance in significance to the clinician the descriptions which may be derived from textbooks and the ideas which are obtained from the ordinary course in descriptive anatomy.

A matter of considerable difficulty to the medical student is a proper understanding of the significance of nerve plexuses in relation, on the one hand, to segmental lesions of the cord, and, on the other, to disturbances in the distribution of peripheral nerves. In other words, the exact relation of nerve roots to peripheral nerves is not forthwith apparent and cannot be made so by dissection. Stimulated by Hardesty's very much more elaborate work, it occurred to us that a simple means of demonstrating by a graphic method the relation of nerve roots to peripheral distribution would be of value in teaching. In carrying out this general idea, the following means suggested themselves which are absolutely simple and at the same time demonstrate in striking fashion the points desired.

A piece of stiff cardboard is the first requisite. On this cardboard, preferably white, are specified the various nerve roots which enter into the composition of the plexus. Each of these nerve roots is represented by a single colored yarn or worsted, and by as many strands as the final distribution of the particular nerve root in the periphery may demand. As the various nerve roots, each represented by its color, break up in the plexus, the strands of worsted are separated and joined with those which come from other nerve roots according to the ascertained anatomical facts, ultimately emerging as the individual peripheral nerve containing fibers of the various nerve roots from which the special nerve has origin. At points where the plexus

¹ Herring: Clay Modeling in the Study of Anatomy. *Jour. Am. Med. Asso.*, 1904, xliii, 454.

² Hardesty: A Class Model of the Spinal Cord. *Bull. Johns Hopkins Hosp.*, 1906, xvii, 43.