people willingly grant even what, to them, appears to be a large sum of money, feeling that a military force for our protection and defence is a necessary part of our national existence. It is the duty of every nation to be prepared for the terrible emergency of war. To be prepared for action is the *raison d'etre* of the existence of a militia. In "the piping times of peace," they have no function to perform. "Ever ready" in every department when the time of duty comes, should be the aim of a well organized force. It is for this object that the country freely spends its money and our young men give their time and energy to assist the work.

To be thus prepared, each part of the system should be a perfect organization in itself. Give us thoroughness of organization in every detail that brave men may have some chance of reward for their heroism when the day of trial comes.

I am not prepared to criticize the merely military part of our militia system. Of this I have no knowledge, but it is apparent that the medical department, I will not speak of as being poorly organized—it is hardly organized at all. The medical department is a most necessary part of the service in the field and if every other part of the system gets proper attention, this should not be neglected.

Every system made for protection in emergency, such as fire, police, and militia are apt to grow rusty from want of action, and require much more watchfulness than one which is in active work every day.

There is an old and instructive story told of the superintendent of a large institution, where a number of people were under care, showing the inspector, who came to visit him how well prepared he was in case of fire, "In that room," said he, "pointing to a door is the hydrant with hose attached ready for action; all you have to do is to turn that key and you are in the room." Suiting the action to the word he attempted to turn the key, but it would not work the key had been changed, the right one was soon found but with some delay, the door opened and everything else found quite ready. The one weak point made the fatal delay and furnished an object lesson to all concerned.

During the Crimean War it is a matter of history that the best and bravest of the British troops were sacrificed by the blundering of an inefficient commisariat. Willing the soldiers were to meet death at the hands of the enemy but to slaughter them, as they were slaughtered, by hunger, cold and disease brought about by a mixture of red tape and stupidity will ever remain a disgrace to the war department of Great Britain.

I would urge again then that the medical department of our militia should receive more attention and be put in proper shape. I may be told that surgeons are attached to every corps and I believe they are well trained physicians and surgeons, but the ordinary training of a general practitioner is not sufficient for a military surgeon. They may be well educated and reliable men, but military surgery is a special work and requires the study of many subjects that seldom come in the line of the practising physician. The present plan of medical organization, poor as it is, is old-fashioned and not in touch with modern military organization nor modern military surgery.

Let us urge then that this department of our militia system be made more perfect and brought up to modern requirements.

I am not prepared to say what would be the best way to accomplish this result, but it certainly is the duty of the government and the chief medical officers of the militia to give the matter study and consideration, and if I might venture a suggestion it would be the establishment of a chair of military surgery in the principal medical schools of the Dominion. I will now leave this subject with the hope that our consideration of this subject may lead to some good result.

Now while I am endeavoring to sketch a larger field for the work of our medical societies and would desire to bring at least some of our proceedings in touch with public necessities; I would particularly urge upon our members, especially the younger men among us, the importance of local medical societies as a means of study and improvement. There are three great sources of knowledge within the reach of the practitioner, they are:—reading, experience and medical societies, and of all these not the least important is the medical society.

There are not as many local medical societies in these provinces as there should be and the necessity for them is not fully recognised.

Of all our sources of improvement, while we are busy at work, there is none better than a medical society. I will not take up your time going over these varied advantages, for they do much good to the profession in addition to scientific advancement.

I have never attended a meeting of our society, even though the meeting were a small one, without feeling a great gain for the short time I have spent there.

We have some few societies in some counties and districts, but there should be more. It may not be an easy task for the busy doctor in a thinly settled district to do much in this direction, still every county at least should have a county society. Even if it could meet only four or five times a year, it would do incalculable good in many ways, but especially in aiding to keep us abreast of the present rapid progress of medical science. I will close with the earnest hope that this meeting like its predecessors may be a pleasant and profitable one.

Vol VII, No 8.

THE GERM THEORY AND SERO-THERAPY.

Presidential address of Nova Scotia Medical Society delivered at con-joint meeting with the Maritime Medical Association, held at Halifax, N. S., July 3rd, 1895.

By A. P. Reid, M. D.

Gentlemen:—

I have the honor to address a much larger representation of the Profession than my position entitles me to, and as a means of courting your favor I will make this address short.

In the first place allow me the pleasure of thanking the Profession of this province for the honor they have conferred on me the past year. I was at some loss to know upon what subject to address you, but the difficulty was to some extent removed when your President, Dr. Farrell took up the relations of the Profession to the public—and I thought my attention had better be directed towards some of the advances that have been made in the scientific departments.

First I will refer to those entities so minutely small that have been lately revealed to us by careful observers and perfect instruments—and I was at a loss to be able to get a definite idea of their forms and peculiarities for under ordinary amplifications assisted by staining methods, we find a lot of little specks that look very much alike, and it is difficult to get a clear conception of them. Others may be similarly situated and I set to work to place them in such relations and so enlarged as to be easily appreciated. I selected ten of the common *pathogenic forms* and had them arranged along side of each other for comparison, which you will see in the micro-photographs handed round where they are enlarged to 1000-2000-3000 and 5000 diameters—but to make them more clear in the chart presented I have enlarged them to 100,000 diameters with careful delineation as to size and

as you can perceive their peculiarities there is no occasion to occupy time in histological description.

Medicine is a science which from the nature of things must be based on that theory which will include the greater number of observed facts, and since there are so many active minds in daily observation and experiment, new facts continually present themselves and the theory of the day must be modified in consequence therewith.

The journals keep you thoroughly posted and as our means of original research are very limited, I do not presume to present you with anything novel—yet it may not be out of place to devote some of your time to the consideration of the latest ideas that occupy the attention of the medical thought of the day.

"There is nothing new under the sun," is as true of our latest advances in pathology as in anything else and perhaps you may be interested if I were to give you some of our forgotten knowledge that has been picked up from old authors.

The *Germ theory* (so called) that received its most perfect demonstration in the recent scientific work on *Tuberculosis*, was forgotten long before its present introducers were born. In a work on consumption of the lungs by Edward Barry, M. D., 1727, he gives at that time an old theory that was given to the world by a Dr. Martin on consumption.

Barry does not give adherence to it but as a matter of duty presents it at at the end of his book, and with your permission I will make a quotation—I brought this subject up last year before a meeting of the British Medical Association of this city.

In quoting from the book and changing a word but not the idea, we are to-day where Martin was nearly two centuries ago. He says; "That ulcers in the lungs when narrowly viewed with microscopes of great power are covered with several insects (bacteria) which disease takes its first origin from such things, which being inspired with the air fix their situation on the lungs and erode and ulcerate them." "Animalcules (bacteria) have been by others supposed to be the cause of several distempers and particularly such as are *contagious*, (the italics are the author's)."

"For it is certain that there is almost an infinite number and variety of such animalcules (bacteria) floating in the air whose chief business consists in searching out a place where they may find nourishment." "But every part of a human body though imperceptible to our eyes is sufficiently strong as to entirely prevent these things so minutely small from fixing there for any time * * * but in a part that is ulcerated, the purulent matter sends forth perpetual streams to nourish them, and by being viscid and adhesive makes their nidus so secure that the ulcerated part is not strong enough to dislodge them." "After the same manner the blasts (diseases) of trees and plants may be more rationally accounted for." "For there is a circulation through every part of plants and trees which is sufficiently strong to prevent these animalcules from having a fixed and sole situation there. But if from many causes there is produced a *stagnation* and a *gangrene* either in any particular part or in the whole such animalcules (bacteria) will quickly secure this quiet state and nourishment."

So much for our recent and greatest advance upon which I need not comment other than to remark that it is no small advance to be able to demonstrate that which was only surmised.

A Special Therapeutics

with *toxins* and *toxalbumins* as a base has been developed quite recently and yet I find that we are only following in the footsteps of our forefathers—We are all aware that the active poisonous agents in the different varieties of snake and some animal poisons are closely related to what we now call

toxalbumins as tuberculin for example—and you will find in Dr. Benjamin Gooch's medical and surgical observations published in 1771, a resume of different ancient practices that have animal poisons as the basis of a rational therapeutics. Of the very many interesting observations he gives, I feel that time will only allow me to quote one.

Dr. Gooch gives a lengthy description of a case of severe pain, spasms, etc., that had endured a long time, and the patient had received no benefit from any one. He consulted Dr. G. who felt he could do nothing for him, but as he says, "Not to appear inhuman to so wretched a being after telling him I could do nothing I sent him a bottle of rattle snake wine to take a glass of frequently. This was in the West Indies drank as the highest cordial. Three nights after the patient walked in "Sir," said he, you cannot be so much amazed as I am nor half so much pleased, I am come to thank you, and if not criminal to worship you," etc.

Dr. G. gives the following history of the discovery of the virtues of rattle snake wine;

"A very wealthy old gentleman in the West Indies had long been afflicted with leprosy to an high degree, which was deemed incurable by his physicians. Apparently in a dying state he made his will and left a large legacy to a female servant who had lived with him many years.

This circumstance being known to her, she and her lover by the instigation of the devil, studied and contrived how to make away with him in such a manner as to raise the least suspicion of their wickedness. They put the heads of rattlesnakes into wine and gave him it to drink thinking it would prove an infallible poison, but as he grew better upon taking it, they, happily for him falsely concluded that it had not been made strong enough. They then made it stronger, and by drinking this intended poison he was restored to perfect health.

Compunction of conscience put this unfaithful and wicked servant upon falling on her knees before her master imploring his mercy, and in tears confessing her atrocious crime. He not only forgave her, but gave her a sum of money ordering her to depart his house directly and never see him more."

Galen, Areteus and other ancients recommended eating vipers for Elephantiasis. Dampier says that the natives of Tonquin, East Indies, treat their friends with arrack in which snakes and scorpions have been infused not only as a cordial but an efficacious remedy for leprosy.

At the Present Day

we are using similar substances given hypodermically and in very minute doses—a new departure in therapeutics but more in the method than the substance. The virus of small-pox, diptheria, hydrophobia, tetanus, tubercle, etc., are not less virulent than the virus of the adder, centipede, rattlesnake—and also chemically they are very closely allied.

These poisons have been used as above quoted with benefit, particularly for leprosy. If the ancients could cure this malady the moderns cannot—we need not ridicule their methods—we may yet adopt them in a round about fashion, as tuberculin in lupus.

Intimately allied to the above subject is our latest advance in the treatment of disease

Sero-Therapy

upon what rational basis can such a practice stand?

To begin at the beginning, certain diseases, small-pox and some others produce as a rule such an influence on the human organism that one attack protects from another attack no matter what the exposure. In other maladies diptheria for example, an attack protects for a certain time, but this im-

munity is limited to a period varying with the individual as well as the malady.

These facts have long been known, but until lately there was no satisfactory explanation. Modern research goes to shew that as a result of Bacterial growth a substance called a *toxin* is generated which is inimical to the further growth of that special type of bacterium—as an illustration—the yeast organism which flourishes in a saccharine solution and produces carbonic acid and alcohol as a result of its growth will lose its virility in ratio with the accumulation of these products—with 10 per cent of alcohol toxins, the fermentation ceases to again go on if sugar be present and the alcohol be removed or much diluted.

This doubtless is the rule with every kind of life—high or low—the products of the metamorphoses caused by its vital activity must be removed or they lead to the death of the individual that produced them.

But the Results of the Latter Research

proceed a step farther. If the animal economy is subjected to the poisonous products of parasitic growth, the *toxin*, there is at the same time a counter-acting agency generated called an *anti-toxin*, which has the effect of neutralizing the poisonous influence of the toxin, and if the vitality of the animal be sufficient it will survive the ordeal and the anti-toxin thus generated will serve not only to neutralize the toxin but render the virulent pathogenic germ not only harmless for ill, but in the end destroy its vitality.

From time immemorial we have spoken of the *vis medicatrix naturae* the physicians great stand by the agency which has perpetuated animal life on this planet, but it is only very lately that we have been able to form any clear conception of how the vis medicatrix functionates.

The next problem was, suppose we grant that an anti-toxin is generated, where was it found? What was it like? How could it be studied?

The answers to those questions are not yet forthcoming, but in the cases of diptheria and tetanus it has been found that there is a something in the serum of the blood which not only protects the individual affected but if this serum be introduced into the blood of one who is liable to be infected it will protect that individual from an inroad of diphtheria or tetanus poison, and if he be invaded this serum will enable the individual to overcome the toxin of the disease, and if not too much under its influence to destroy the invader and restore him to health.

This is the basis of the treatment now being introduced and which is well named serotherapy, thanks to the researches of Pasteur, Koch, Fraenckel, and the other careful persevering workers. Diptheria has been worked out as follows:—Klebs in 1883 discovered the bacillus which is considered distinctive of it, and with Loeffler studied it carefully, but though able to produce diptheria in animals they were unable to produce the paralysis etc. so distinctive of this malady.

Roux and Yersin in Paris 1888, reproduced the paralysis by introducing into the circulation the toxin separated from the bacillus. Behring and Kitasato (of Japan) in Berlin, by means of the toxin caused immunity which they found was produced in the blood and named it anti-toxin. It was found that it was present in the serum. Behring and Ehrlich in Germany and Roux in Paris rendered it practically available. There were many workers in this field each adding his mite to the general result, as Wasserman, Aronson, Brieger, and Woolridge in England, and Ogata in Tokio, Japan, etc.

There is not in the history of medicine a more careful series of long continued research and experiment

than that which culminated in the serotherapy of to-day, which is only an index of what is to come, time and experience must demonstrate its imperfections and their correction. The many steps in the careful journey of the past 15 years are most interesting, and to dwell on them would unduly extend this paper and it may be sufficient to give the technical method of preparing the anti-toxin.

It has been found that certain animals are immune to certain kinds of pathogenic organisms, or in other words, that the vis medicatrix naturae has greater energy in generating the anti-toxin, and advantage is taken of this to produce the so much desired remedy, as for example—the horse has great resisting power against the toxin of diptheria bacillus and by skilful manipulation the serum of the horse's blood can be made so strong in that special type of anti toxin that a very small amount of this serum will render an animal (wanting in this immunity) immune to the diptheria toxin.

Different experimenters vary a little in detail but not very much. Roux of Paris injects pure diptheria toxin into the horse (which must be in the best of health,) at stated intervals increasing the dose at each injection. But as each new injection of toxin neutralizes the anti-toxin at the time in the blood of the horse it takes a long time (months) to render the serum sufficiently potent for medical use. Klein injects attenuated diptheria (old culture) bacilli with the toxin and then large quantitles of living bacilli of gradually increasing virulence are repeatedly injected. These produce a rise in temperature and local tumour but no suppuration, and the time is lessened half with the production of a satisfactory serum.

Whilst the animal is undergoing this preparation, the serum is regularly tested on guinea pigs, by taking a known toxin and to 10 times a fatal dose adding the anti-toxic serum and injecting it into the guinea pig to be followed by no ill result. It is known as to strength by *unities* of which ½ C. C. neutralizes 10 times a fatal dose.

The serum is being made so much stronger lately that much less is required than was needed at first, where from 50 to 150 *unities* will act as a prophylactic—from 600 to 1600 *unities* will be required to cure a severe case. For immunizing or acting as a prophylactic, small doses repeated every few weeks during the epidemic will suffice.

The serum immunizes more rapidly than would an attack of the disease but it does not last so long. The serum does not generally act unkindly on its recipient, but every day is widening our experience on this subject and the opinions which prevail to-day are likely to be modified to-morrow.

There is a prospect that in time we will not require to go to the lower animal for the medicament, for lately Dr. Smirinow under Prof. Nencki, of St. Petersburg finds that by passing a continuous electric current of from 100 to 200 miliamperes through a very virulent diptheria culture after 18 hours of electrolysis this culture acquires the power of curing a rabbit inocculated with diptheria some hours before. Thus anti-toxic properties are produced without the intervention of animal tissues.

There are anti-toxins of other types of disease that are present in the tissues, as for example in the spinal cord in hydrophobia but enough for this paper. However, the great advance made of late in clearing the ground and opening up avenues of research lead us to hope that it will not only point out the unknown and make us familiar with it, but also show us how to relieve the afflicted.