Address.

THE SEGREGATION OF CONSUMPTIVES.

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Mr. President and Fellows of the Massachusetts Medical Society:

The physician's path, though a good one to follow, is neither smooth nor easy. His life is a warfare, from the diploma to the grave — a warfare demanding the constant use of all his powers, but whose visible rewards are not commensurate with his expenditure of force. He strives not for himself, but for others, and others enjoy the fruits of his victories. But this fact does not deter men from entering our profession. Rather does it tend to draw into it those who wish to lead fruitful lives, and it gives to the medical vocation a satisfaction which is beyond all material returns. The physician is not a soldier of fortune, seeking only gold and glory, but a crusader enlisted in the army of God, and fighting for the rescue of suffering humanity. This is the crowning glory of the doctor's life, and it is this unselfishness which ennobles his profession, and gives him a great and peculiar influence — an influence which is generally recognized by the community and which brings him great opportunities for usefulness.

Thus it comes about that a medical practitioner is, to a greater or less extent, a missionary. He is always finding and doing some work, unpaid or underpaid, for his fellowmen, because his training and his position render such work possible and natural. In freely serving the poor, in their homes or in hospitals, his opportunities for good are not exhausted. In all philanthropic measures he is to be relied upon as a helper, and in those directly pertaining to the public health, he is naturally a leader. He has unequaled facilities for disseminating knowledge, for awakening interest and for guiding benevolence. The evidences of this influence are to be seen on every hand. Have you not all exerted it? and have not your laborious lives been brightened and sweetened by your success?

If the influence of the physician in his individual capacity is so great, how much greater must be that of the profession as a whole! When this acts as a unit great things can be accomplished, and our medical societies render such action possible. This organized force has done good work in the past: it has persistently opposed error with truth, ignorance with knowledge, charlatanry with science; it has given to the world the benefit of those marvelous discoveries of the past century which have prevented untold suffering and rescued millions from death; and it stands ever ready to champion every good cause whose object is to save human lives and make them better worth living.

It is therefore the thing to be expected that we, Fellows of The Massachusetts Medical Society, on this our anniversary, should ask ourselves and each other, "What is the cause which this year most urgently demands our help?" I think you will agree with me that the one paramount problem which to-day confronts us is the suppression of tuberculosis, and that this is the cause which now calls most loudly for our united and hearty support.

The knowledge that it is possible to exterminate this scourge of our race has deeply stirred the minds of men — and flooded the world with the light of a new hope. A mighty war is now in progress — a war which is uniting under a common banner people of every race, color, language, nationality, class, party and creed. Already have notable victories been won, but we are still in the early stages of the campaign, and it will require years of valiant and united onslaught to rob tuberculosis of its terrors. Meantime, the people look to us for leadership; and it is incumbent upon us to consider, year by year, what battalions are to be organized, what engines of war constructed and what tribute levied upon the community for the successful conduct of the campaign.

As a contribution to the discussion of this subject, I will ask you to consider with me that one of its branches which seems to me of the highest importance, namely, the prevention of consumption by the separation of the sick from the well.

Since pulmonary tuberculosis is known to be actively infectious, through a specific germ, it is perfectly evident that the isolation of all infected persons would, in a few years, stamp it out. It is the leprosy of our time; and, as leprosy is kept under control by the segregation of lepers, so may consumption be eradicated by the segregation of consumptives.

Let us suppose all the power in our country to be centered in a despot of unlimited power and wealth, and also filled with a burning desire to confer great blessings upon his subjects. Such an one might say, "Consumption is the greatest enemy of my people. I will destroy it, and that quickly." Could he do it? He could; and how? He would order the formation of many great camps, or enclosures, where all consumptives would be forcibly colonized. These would be placed not far from the cities and towns, but far enough to find pure air and sunshine. There would be tents, cabins or shacks for the incipient cases, and hospitals for the advanced. There would be ample space and much freedom within the camp, but no passing the bounds. Here many early cases and some of the advanced ones would be restored to health and be permitted to return to their homes, while those who must die would have their illness brightened by good care and every possible alleviation. By this removal of consumptives, infection would cease, and since the patients would no longer leave the disease as a legacy to their families, new cases would grow fewer and fewer. The change in ten years would be marvelous, and if our supposed despot should live to the good old age he would deserve, he would see his camps nearly deserted and consumption dwindling to an insignificant place in the mortality tables. At the end of his benefi-

cent reign, his grateful people would erect a monument inscribed with these glorious words, "To the Conqueror of Consumption."

The day of despots has now gone by, but the power which they wielded still remains, vested in the people, and the people are able to accomplish this same result. When once they are educated up to the idea, when they fully understand that the thing can be done and that the doing of it will save multitudes of lives and remove one of the chief causes of suffering, poverty and sorrow, will there not be a great popular uprising, when the people themselves will demand the enforcement of this act of depotism, which will separate the infected from the uninfected, to the end that the plague may be stayed? They will be a little longer about it than our despot would have been, — measures too arbitrary and violent might engender sedition and wreck the treasury, — and they will try to bring about the desired result without too much restraint of personal liberty and without danger of financial disaster, but in good time this thing will be done. It is safe to prophesy that the days of tuberculosis are numbered and that future generations looking back upon our time will say, "There were giants in those days, for they destroyed that arch-enemy, consumption."

Through the untiring efforts of a great number of medical men, and some very earnest laymen, the people are being taught the value of local associations, of medical inspection, of visiting nurses, of anti-spitting regulations, of disinfection of houses, of registration of cases, of out-door life, of dispensaries and of sanatoria for incipient cases. But the most urgent need of all, the hospital for advanced cases, is not yet sufficiently recognized. It is not a philanthropic interest in the patients themselves which is the chief reason for building these hospitals, though this would be reason enough; but there is a far more weighty one,— the prevention of infection, whereby alone the endemic may be arrested. The public need be shown the necessity for such hospitals, and state, city and town governments should be brought to realize that the appropriation of public funds for this purpose is a patriotic duty on grounds not only of humanity, but of self-preservation. The vast expense, however, will be an almost insuperable obstacle to the sufficient carrying out of the plan. But it is a war measure and we must learn to consider it as such. "Millions for defense" are not begrudged against human enemies, and why should they be against the far more hostile and bloodthirsty bacilli? But, for the relief of the overburdened tax-payers, we need also to enlist the interest of private philanthropy. Persons of wealth should be shown that in no way can they use their means to help their brother-men more wisely and efficiently than by building and maintaining these hospitals for consumptives. This needs to become the great popular charity.

The state of Massachusetts, which built at Rutland the first state sanatorium for incipient cases, is wisely undertaking to provide also for advanced cases. A "Commission to investigate measures for the relief of consumptives" was appointed a year ago, and presented its report last March. So admirably was this report prepared, so wise were its suggestions and so convincing were its arguments, that already has the legislature passed bills carrying into effect nearly all of its recommendations. These bills provide, first, for the immediate construction of three infirmaries for tubercular patients, of 150 beds each; second, for the appointment of state inspectors of health; third, for compulsory registration of cases; and fourth, for giving greater effect to the anti-spitting law. Surely this is a remarkable result. A commission which has brought the enactment, in a single session, of so many beneficent laws is entitled to our gratitude and admiration. Three of its six members are Fellows of The Massachusetts Medical Society, and it is fitting that their names should be mentioned and remembered. They are Dr. H. P. Walcott, Chairman of the Commission and Chairman of the State Board of Health, Dr. A. S. MacKnight of Fall River, and Dr. C. S. Millett of Brockton, Secretary of the Commission. Their lay associates are Messrs. Brackett, Adams and Porter.

To this roll of honor should be added the name of Senator Frank M. Chace, of Fall River, who had charge of the "Three Sanatoria" bill; of Ex-Representative Googins, of Cambridge, who for four years, from 1901 to 1904, tried to secure the passage of a similar bill, and of Senator Frank G. Wheatley, M.D., another Fellow of our Society, who had charge of the bill providing for State Inspectors of Health.

There are many others who have been active in securing this beneficent legislation, but I will here add but one other name, that of Governor Curtis Guild, Jr., who, in his last inaugural, recommended measures for the relief of consumptives, and who has done all in his power to advance it.

This commission undertook a census of consumptives in Massachusetts and obtained from physicans reports of 7,779 cases, of which about one third are classed as incipient. But, as the Secretary of the Commission stated to a committee of the legislature, the actual number of cases is probably double these figures, which seems extremely likely, when we consider that there are 5,000 deaths annually. It is quite safe to place the number of consumptives in the state at 15,000, of whom 5,000 or less are incipient, and 10,000 or more advanced. Let us inquire how nearly the three new infirmaries will come to accommodating this number.

We have already in the various institutions of the state about 400 beds for incipient cases and 500 for advanced — making 900 in all. The 450 beds in the three new infirmaries will make 1,350. Each bed will be sufficient for two or perhaps three patients a year. If we say three patients a year, the 1,350 beds will provide for 4,000, leaving 11,000, or nearly three quarters, unprovided for.

The building of these infirmaries, therefore, is not going to be enough to stamp out the disease,

but it is a long step in the right direction; it will afford much relief and will be an object lesson to demonstrate their value and the necessity for increasing their number in the future.

It will not take long to show the value of this separation of advanced cases. When we remove them from their homes and from public places, the number of incipient cases will begin to fall off. Every person with advanced tuberculosis is likely to infect at least one other person, so that under present conditions there is no possibility of the disease dying out.

The long continuance of the disease renders impossible such house quarantine as is enforced in the case of smallpox, scarlet fever, measles and diphtheria. However careful may be the patient and his family, there is always danger that, through some relaxation of the rules, germs may be conveyed to another person. Such accidents may happen through forgetfulness, weariness, excitement, intemperance or delirium. In the last stages of the disease the patient often expectorates at random all over the bed, the floor and even the walls, thus endangering the wife or daughter who is in attendance, other members of the family who pass through the room, and children who may be creeping upon the floor. Such cases ought not to die at home. They should be moved to a hospital, where they can have more comforts, and not be sowing the seeds of disease among those whom they love best. This separation will be resisted at first on sentimental grounds, but the arguments for it are so strong that resistance will lessen with time. Especially will this be the case if these hospitals are not placed at such a distance as to forbid frequent visits from members of the family. These visits, which can be made without danger, will relieve homesickness and make the separation less complete and depressing than it would be if the patient had to be removed far from home.

The sanatoria for incipient cases are doing a great work restoring to health a considerable number of persons who would otherwise die. At Rutland, during the eight years since the sanatorium was opened, the number of cases discharged "arrested or apparently cured" has been 1,487, or over 41% of all cases treated. This is a handsome showing; it justifies the outlay for the sanatorium, and is full of encouragement for the future; but, compared with the number of consumptives in the state, the figures are not large. It has been the policy of the sanatorium to restrict it to incipient cases, and such are never refused, but hitherto there have not been enough such applicants to fill the beds, and rather than to let the beds remain empty, a sufficient number of moderately advanced cases to fill them have been received. At present the number of incipient applications has increased to such an extent that few advanced cases can be received, and the question every day arises, What can these people do? The doors of Rutland are closed against them, and properly so, for these incipient cases have the prior claim; but their need is great, and there is, as yet, no place for them to go.

The number of rejected applicants last year was about a thousand, and if we add to these nearly 400 more who, after a few weeks or months, were found not to respond to the treatment and were discharged, these alone are sufficient to fill the three new hospitals which are now proposed. This proves the urgent necessity for their speedy construction.

In Massachusetts the provision for incipient cases at present consists of the State Sanatorium at Rutland, with 350 beds; and two private sanatoria — that of Dr. Bowditch at Sharon, and that of Dr. Millet at East Bridgewater, each with about 20 beds.

For advanced cases, about 250 beds, or half of all those in the state, are in Boston institutions, namely, the Channing Home, House of the Good Samaritan, the Cullis Consumptives' Home, the Free Home for Consumptives, St. Monica's Home for Colored Women and Children, the Boston Almshouse and Hospital, Carney Hospital.

Outside of Boston, the principal provision is at the Tewksbury State Hospital, which has 140 beds for consumptives, besides a camp of 36 beds. The other institutions, where advanced cases are received, are: the Holy Ghost Hospital for Incurables, Cambridge; Lowell City Hospital, Fall River City Hospital, several private hospitals in Rutland and Miss Sullivan's private hospital, Pittsfield.

A Sanatorium for Consumptive Prisoners is also just completed at Rutland, and the Danvers Insane Asylum has separate cottages.

To this list may be added the Mattapan Day Sanatorium, maintained during the warm months by the Boston Association for the Relief and Control of Tuberculosis, and the Day Sanatorium of the Lowell General Hospital. A certain number of consumptives are also to be found in insane hospitals, almshouses and prisons. The general hospitals, as a rule, receive such only in exceptional cases.

Boston is soon to have a large addition to its facilities in the Consumptives' Hospital now about to be built at Mattapan. In establishing this hospital this city has set an example which every other city will do wisely to follow.

Besides what is being accomplished by the sanatoria and hospitals, much good work is being done by dispensaries and clinics. Among these are to be specially mentioned the tuberculosis clinic of the Boston Dispensary, conducted by Dr. Otis; the Out-Patient Departments of the Massachusetts General Hospital, Boston City Hospital and Carney Hospital, the Berkeley Infirmary and Trinity Dispensary. The tuberculosis classes have also proved extremely useful, and are well worth study and imitation. These are "for the home treatment by sanatorium methods of incipient and moderately advanced cases." Such are the Emmanuel Church Tuberculosis Class, conduced by Dr. Joseph H. Pratt; Arlington Street Church Tuberculosis Class, by Dr. N. K. Wood; Suburban Tuberculosis Classes, by Dr. John

B. Hawes, and the Cambridge Tuberculosis Classes.

The Boston Association for the Relief and Control of Tuberculosis, and similar organizations in Cambridge, Worcester, Springfield and Brockton, have also become important factors in this great and many-sided enterprise.

By these various means tuberculous patients are treated in their homes, are instructed in the methods of cure and prevention, receive the care of physicians and visiting nurses, some receive aid, and some are enabled to go on with their usual occupations.

All of this work is of great and far-reaching importance, but would be made infinitely easier and more effective if the hospital accommodations were sufficient for those cases in which the home conditions are unfavorable. That these conditions are unfavorable in a large proportion of cases we all know, and we also know how utterly inadequate are our 500 beds to the needs of the 10,000 advanced cases in the state.

In other states the lack of provision for advanced cases is as great as in our own, and in most cases greater. For incipient cases provision is becoming abundant. The sanatorium method, which was orginated by Brehmer in Germany in 1859, and which was first put into operation in this country by Trudeau at Saranac Lake in 1885, has been attended with such wonderful results that these institutions have rapidly multiplied. They are now to be found in nearly all of the northern states, New York standing at the head of the list, and the majority being private institutions. But the example of Massachusetts in building a state sanatorium has been followed, and there are now fourteen state sanatoria, completed or building, besides three others which receive state appropriations. The United States government has established sanatoria : at Fort Bayard, N. M., for the army; at Fort Stanton, N. M., for the Public Health and Marine-Hospital Service, and at Fort Lyon, Col., for the navy. These old military posts, no longer needed for fighting the Indians, are now attaining a higher usefulness in the war against consumption.

These various sanatoria, whether private, state or national, are almost wholly devoted to incipient cases. For advanced cases the provision thus far is mostly limited to large cities, and is made by the municipalities or by charitable and religious societies. Provision is also made in some states for the care of tuberculous insane and prisoners. The segregation of consumptives in the United States, however, is still in its infancy, and is very far from attaining that general and systematic character which alone can have any radical effect in suppressing the disease.

In Europe the conditions are much the same as here. The tuberculosis campaign on that side of the ocean is being pressed with extraordinary vigor. But it is the sanatoria for incipient cases which, at present, are receiving the most attention. Germany, the fatherland of Brehmer and Koch, leads the world in this respect, having over 100 sanatoria with 10,000 beds. Dr. Locke's recent article in the BOSTON MEDICAL AND SURGICAL JOURNAL gives a most interesting account of the "Crusade against Tuberculosis in Germany," and explains the part taken in it by the Workingmen's Insurance, the German Red Cross and the German Central Committee for the establishment of sanatoria for diseases of the lungs. But of all this great number of sanatoria, there are very few for advanced cases. The latest report I can find describes only 8, mostly small, but including one large one at Grosshansdorf, with 200 beds, built by the Workingmen's Insurance fund. In several German cities separate wards for advanced consumptives are provided in general hospitals, and much is also being done for this class through dispensaries and polyclinics, but the need of increased provision for these cases is deeply felt. As von Leube says, almost all of the existing German sanatoria are open only to a small minority of the cases, namely, the early incipient, whom he estimates at about 30,000; while for the advanced cases, of whom there are supposed to be 1,000,000, very scanty accommodations are provided.

In England, and elsewhere in Europe, the situation is much the same as in Germany. The care of early cases by sanatorium treatment is now chiefly engrossing the attention of the civilized world, while the advanced cases, far greater in number, and far more likely to spread the infection, remain in their homes, where they are receiving, it is true, an increasing amount of care through dispensaries and visiting nurses. This sort of care, however, cannot prevent the transmission of the disease to their families. The danger may be lessened, but in the home it is, in the great majority of cases, practically impossible to avert it.

The next step in the campaign will be to undertake the prevention of consumption by separating the sick from the well. For this, two things are chiefly necessary: first, to provide ample hospital accommodation for advanced cases; and second, to establish some systematic supervision over those who, for any reason, cannot be removed from their homes.

Fortunately, in Massachusetts, both of these wants are in a fair way to be supplied through the new laws but just enacted, one providing for three new sanatoria, and one for state inspectors of health. The commission recommended that these sanatoria should be inexpensively constructed, at a cost of about $500 a bed; and the appropriation is based upon this modest estimate, which is much less than the usual outlay for such institutions, most of them, including that at Rutland, having cost something more than $1,000 a bed. One of the newest in England, the King Edward VII Sanatorium at Midhurst, cost $1,000,000 for 100 beds, or $10,000 a bed, and is no doubt the most expensive of its kind. Since the construction of such sanatoria on a large scale now seems inevitable, a minimum of cost is a highly important desideratum, and if it can be demonstrated that a sanatorium embodying all the essentials, and not of too inflam-

mable materials, can be built for $500 a bed, the segregation problem will be materially simplified.

As we have seen, these three new sanatoria are likely to be filled up promptly with the overflowings of Rutland, — that is, with moderately advanced cases; but the great majority of consumptives will still be left, many of them unfit to be moved beyond the limits of their own town or city. For these, local hospitals are an urgent necessity, and no question can be more important than how to convince the public of their necessity and how to bring about their construction. The plan of construction is of minor importance. There will have to be an administration building, sufficient for future as well as present needs, about which may be grouped cheaply-constructed wards, cottages or shacks, which can be increased in number as needed. These should, if possible, stand in a plot of ground several acres in extent, and, while pure air and sunshine are essentials, the location should be near enough to a center of population to insure water-supply, drainage and fire protection as well as to permit frequent communication between the patients and their homes. In small towns a farmhouse may be utilized, while in larger towns and cities special buildings will be constructed or special wards added to existing hospitals, as at Fall River and Lowell.

As regards the size of these hospitals, a good rule might be to provide one bed for each thousand of the population, with the expectation of increasing in the future. At this rate it is evident that, in the smaller towns, only cottage hospitals would be required. A city of 100,000 population would have a hospital of 100 beds, costing, at $500 a bed, $50,000, and the annual cost of maintenance would be about the same as the cost of construction, or $50,000 a year. In cities and manufacturing towns, which have the largest ratio of consumptives, the hospitals will need to be larger in proportion to the population than in the rural towns.

It is to be confidently expected that philanthropic citizens, when they become convinced of the importance of this measure, will help to lighten the strain upon the public purse by donating land and buildings and contributing to a fund for their maintenance.

If all of these institutions are called sanatoria, it may be easier to induce patients to go to them than if they are called hospitals, though the word "hospital" has a far more cheerful sound in these days than it had a few decades ago.

What, then, can we, members of The Massachusetts Medical Society, do the coming year to help on the campaign against tuberculosis?

We have been considering two propositions: first, that we are a united body of missionaries who esteem it a duty and a privilege to aid any good cause whose object is to rescue the human race from the tyranny of disease; and, second, that we have arrived at an important crisis in the world's history, when a great discovery has shown us the possibility of annihilating tuberculosis. The truth of both of these propositions is so obvious that the only possible conclusion is that we must all, individually and collectively, launch ourselves into this campaign and determine that each year shall become memorable through the achievement of some notable victory.

Encouraged and stimulated by the brilliant successes of the past year, we can now look forward with new confidence and see more clearly where our duty lies.

The *prevention* of tuberculosis rises at the present time into special prominence, and it has been my endeavor to show that the ideal way to accomplish this is through the segregation of the sick. The new state sanatoria will greatly facilitate this separation, and it will be incumbent upon us to induce our patients to go to them, and to convince them that this is best for themselves and necessary for the protection of their families.

We can also agitate for the erection of additional local hospitals for advanced cases, and do what we can to interest people of wealth and liberality in this method of helping their neighbors. If this sort of missionary work is done only by a few of us, the results will be insignificant; but if we all take hold and do it together, enthusiastically and aggressively, a general and widespread interest will be awakened and we will have something to show for it a year hence.

But let me not be understood as urging activity in this one direction to the neglect of others. The problem is a complex one, and the campaign in many other directions is well under way. It is necessary to continue the attack with increased activity along the whole line. Here are some of the ways in which we can render efficient help:

We need to show our approval of the recent acts of the legislature by doing all we can to make them effective. To this end we must carefully comply with the law requiring notification of cases of tuberculosis to the board of health.

We can, whenever occasion offers, explain the importance of the anti-spitting law.

We can cordially co-operate with the state inspectors of health, who are to be appointed, and give them our support in the work they are to undertake, which is expected to result in a systematic organization of the war against consumption.

Moreover, we can lend our aid to the associations for the relief and control of tuberculosis; we can urge the appointment of visiting nurses, the establishment of day camps and dispensaries; we can take pains to see that the disinfection of houses after the removal or death of consumptives is thoroughly performed, and we can bring to the notice of manufacturers the admirable work which is being done in the factories of Providence, of Oxford and of Brockton.

Again, we can accomplish something in our district societies, by means of the committees on tuberculosis, which were appointed year before last, through the active initiative of Dr. A. T. Cabot, then president of the State Society, and now president of the State Committee on Tuberculosis. One way in which the work of these committees can be facilitated is by providing

them with funds for carrying on a campaign of education.

Having done all these things in the capacity of medical missionaries, there is one other thing which, as medical practitioners, we must not leave undone. We must seek out the incipient cases and send them to Rutland or some other sanatorium while they are yet in the curable stage. We can do this by being always on the watch for danger-signals, by making a careful physical examination in all cases of suspicious cough, of emaciation, of slight rise of temperature, of unexplained debility; by making early examinations of sputum; by not delaying to tell our patients of their condition and by carefully explaining to them how much better are the results of sanatorium treatment in an early than in a later stage. We must preach the gospel of out-door life, and must insist that any of our patients who cannot go to a sanatorium shall have the open-air treatment at home.

And even this is not all. We need to keep constantly before the minds of the people that consumption can also be combated by improving the stock, by bettering the conditions of the working-people, by seeing that they are not deprived of light and air in their homes and the places where they work, and by preventing poverty, vice and intemperance. If those influences can be overcome which tend to sap the vitality of the race, infection will be less frequent, even though exposure continues.

Thus the problem of tuberculosis is found to involve the whole science of social economics, and to demand for its solution the combined efforts of all those who are striving in any way to improve the conditions of the human race. This is a holy war, and in it let us, Fellows of The Massachusetts Medical Society, do our full share of the fighting. Let us inscribe on our banners "Consumption not only can be cured, but it can be and shall be *prevented*."

Original Articles.

ACIDOSIS.*

BY ELLIOTT P. JOSLIN, M.D.,
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THIRTY years ago this spring in Strasburg, Walter [1] published an account of a series of experiments on acid intoxication, which were more conclusive than those of previous writers. He discovered a marked degree of uniformity in the symptoms after the administration of hydrochloric acid to rabbits. If the quantity of acid inserted into the rabbit's stomach exceeded 0.9 gm. per kilogram in one day, death could be predicted within a few hours. The phenomena were ushered in by increased frequency of respiration. Each respiratory movement was deeper, more labored and accompanied with forcible heaving of the body walls. The animal lost the power of moving freely about and remained quiet in the position assumed. Having reached this stage one quarter of an hour intervened until death. The dyspneic character of the respiration now diminished, the blood pressure, which had been raised, fell and the heart's action grew scarcely perceptible, yet respiration invariably ended before the heart ceased to beat.

The administration of acid to dogs failed to produce similar symptoms, although double the quantity of acid was fed. Walter was so fortunate as to detect the reason for this immunity and to show that it lay in the capacity of the dogs to protect themselves by the formation of ammonia and the neutralization and excretion of 75% of the acid administered as an ammonium salt. This difference between the action of acid in dogs and rabbits has been shown by Winterberg [2] and others to be only relative, since rabbits can also protect themselves to a limited degree by the formation of ammonia, and on a proteid diet are less susceptible to acid poisoning,[3] while, on the other hand, dogs succumb with similar symptoms if the acid is injected into the veins. There is, in fact, general agreement from Walter's [4] time until now that symptoms of excitement with dyspnea, coma and death follow the intravenous injection of acid in rabbits, dogs and sheep.[5]

Much evidence has accumulated to prove that the cause of death is acidosis. The intravenous injection of an alkali simultaneously with even double or treble the ordinary lethal dose of acid prevents the occurrence of symptoms, and the introduction of an alkali, when death is imminent from acid poisoning, brings recovery.[6] It is, therefore, improbable that structural changes in the tissues have taken place, and indeed none such have been found.

The symptoms above recounted are not specific for any one acid, — hydrochloric, phosphoric, acid sodium phosphate and lactic acid.[7] They are distinct from symptoms attributable to poisoning with salts. They may resemble those of sodium nitrite and other drugs,[8] but the presence of such drugs in experimental acid poisoning has not been demonstrated.

The formation of ammonia is the response of an aminal to the injection of an acid. So far as I know, all agree that ammonia is a measure of acid metabolism, whether the acid is introduced into the body or formed within it.

Hallervorden [9] was able to show that the production of ammonia grew less when alkalies were injected. Ammonia is a "factor of safety" in our metabolism, and it is interesting to note that its neutralizing power is five times that of the common extraneous alkali — sodium bicarbonate.

Confirmation of acid poisoning is further found in the diminished power of the blood of these animals to neutralize acids. This can be estimated by the amount of carbonic acid present, because carbonic acid is displaced from its loose combination by any of the acids considered. Walter [10] showed in his fatal cases of acid poisoning in rabbits that the carbonic acid was lowered 90%,

* Read before the Association of American Physicians, Washington, D. C., May 9, 1907.