

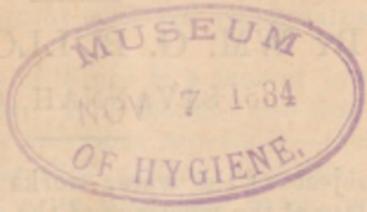
1313

A. L. Gibby

WATER WORKS SUPPLY

For and Supply Water for a Building, Frank of New

LOCH, M. D.



4618

Faint, mostly illegible text, likely bleed-through from the reverse side of the page. Some words like "MUSEUM OF HYGIENE" and "NOV 7 1884" are visible in reverse.

WATER WORKS SUPPLY.

Pure and Impure Water in a Sanitary Point of View.

BY WM. G. BULLOCH, M. D.,

SAVANNAH, GA.

As the subject of the water works supply has been a matter discussed of late at the meetings of the Medical Society of this city and is now under consideration, I understand, by the City Council, as well as a matter of interest to the whole community, and I am myself deeply interested in the subject, I take this occasion to lay my views before the public, hoping thereby to elicit some discussion of a matter of such vital importance to our citizens, from those who may have more enlightened views affecting the health, happiness and prosperity of this city.

Now, as, I am but a tyro in science, I admit, and may not possess a personal knowledge of the subject in all its bearings, but I have for some time past been studying up the subject, and in an article I prepared for publication some years since, I presented my own views and substantiated them by quotations from the best authorities I could find. And first, I referred to what Dr. Parks says in his work on "Medical Hygiene," prepared especially for use in the medical service of the British army, and furnished by our own government, from its intrinsic merits, for the benefit of the medical staff of the United States army.

"Soldiers," says Dr. Parks, "should be taught by their medical officers that there is danger in drinking turbid water, as they will often do when they are overcome with thirst. Not only all sorts of suspended matters may be gulped down, but even minute animals. On some occasions the French army in Algiers suffered from the men swallowing small leeches, which brought on dangerous bleeding. The leeches are so small as to look like small bits of vegetable matter, fixing themselves in the pharynx (the posterior part of the mouth), the posterior nares, etc., more rarely in the larynx, causing repeated hæmoptysis, epistaxis, or asphyxia."

An instance of this occurred in this city, and came to my knowledge, from the use of the hydrant water, with a gentleman who was in the habit of throwing the water up in his face and dipping his face into the basin of water while bathing. Suddenly

without ever having had a hemorrhage from the nose, drops of blood began to trickle down, and after making an effort to blow his nose, a leech from a quarter to half an inch long was expelled therefrom, to his manifest relief, and the consequent arrest of the hemorrhage. Upon careful inquiry in no other possible way could the leech have attached itself within the nostril but in the way described, and from the use of the hydrant water.

Again, as consequences of an insufficient and impure supply of water, the Health of Towns Commission in their invaluable reports to the British Government collected much valuable information on this point.

The result of such a state of things is a general lowered state of health among the population. It is thought also that certain skin diseases, and the epiphytic affections especially—that is, diseases arising from vegetable parasites getting into the system—and ophthalmia, in some cases, arise from this cause, and are thus propagated.

It has also appeared that the remarkable cessation of spotted typhus among civilized nations is in part owing, not merely to better ventilation, but to the use of a purer and better supply of water.

The deficiency of water, leading to the insufficient cleansing of sewers, has a great effect in the spread of typhoid and choleric diarrhoea. And cases have been known in which outbreaks of the latter disease have been arrested by a heavy fall of rain. This, then, shows the importance to the health of the city of Council providing a full supply of pure water, and also such a connection between the water works and the sewers running through the city as to provide for their regular and thorough cleansing in times of drought. For to this in part I am disposed to attribute the good health of the city in heavy falls of rain. At present, owing to the difficulty of making accurate analysis of water, the exact connection between impure water and disease does not stand on so precise an experimental basis as might be wished. There are some who deny that even considerable organic or mineral impurity in water can be proved to produce any bad effect, while others believe that some mineral ingredients, such as carbonate of lime, are useful. One writer, indeed, has proposed to add carbonate of lime to water to supply lime for our bones, and even so excellent a writer as Johnston has supposed that in Ireland the deficiency of lime salts is supplied by the large amount of lime in the water which in so many parts of the country is supplied from the mountain limestone.

It may be true that water containing a large quantity of organic matter, or much sulphate of lime or magnesia, has been used for long periods without any ill effects, examples of which are stated by two French writers, Parant Duchatelet and Boudet.

In some of these cases, however, very little careful inquiry has been made into the state of health of those using the water, and that most fallacious of all evidences, a general impression, without careful collection of facts, has often been the only ground on which the opinion has been formed. As well observed by Mr. Simon, in one of his philosophical reports (second annual report to the city of London), we cannot expect to find the effect of impure water always sudden and violent; its results are indeed often gradual, and may elude ordinary observation, yet be not the less real and appreciable, by a close inquiry. In fact, it is only when striking and violent effects are produced that public attention is arrested to the subject, the minor and more insidious, but not less certain, evils are borne with the indifference and apathy of custom. This much seems to be certain, that, as precise investigations proceed, and indeed, in proportion to the care of the inquiry and the accuracy of the chemical examination, a continually increasing class of cases is found to be connected with the use of impure water, and it seems only reasonable to infer that a still more rigid inquiry will further prove the frequency and importance of this mode of origin of some diseases. Animal organic matter, especially when of fecal origin, vegetable organic matter, when derived from marshes, and some salts, are the principal noxious ingredients. The quantities of these ingredients, which should not be exceeded in good drinking water, I may give hereafter, as well as the methods of getting rid of them, but as they do not come within the scope of this article I will omit them at present.

Of the various mineral ingredients the least hurtful substances appear to be carbonate of soda and chloride of sodium when not present in too great quantity. Carbonate of lime, when not exceeding twelve to sixteen grains per gallon, is not usually considered unwholesome, though it remains to be seen whether a more careful inquiry will not indicate some effect on digestion or assimilation to be produced by the constant use of such water. The salts usually considered hurtful, except when in very small quantities, are sulphates of lime and magnesia, chlorides of calcium and magnesium, nitrates and nitrites, and butyrate of lime.

In consonance with my expressed design of treating this subject in a practical way by enumerating diseases which have, on good evidence, been attributed to impure water, I will first allude to affections of the alimentary mucous membrane.

It is reasonable to suppose that the impurities of water would be likely to produce their greatest effect upon the membrane with which they come first in contact. This is found to be the case.

Symptoms which may be referred to the convenient term of dyspepsia, and which consist in some loss of appetite, vague uneasiness or actual pain at the epigastrium (pit of the stomach), and slight nausea and constipation, with occasional diarrhoea, are caused by

water containing any quantity of sulphate of lime, chloride of calcium, and the magnesian salts. Dr. Sutherland found the hard water of the red sand stone rocks, which was formerly much used in Liverpool, to have a decided effect in producing constipation, lessening the secretions, and causing visceral obstructions; and in Glasgow, the substitution of soft for hard water lessens, according to Dr. Leech, the prevalence of dyspeptic complaints.

It is well known that grooms object to giving hard water to their horses, on the ground that it makes the coat rough—a result which has been attributed to some derangement of digestion. Diarrhœa has been known to be produced by such conditions.

First. Suspended mineral substances—clay, marl—as in cases of the waters of the Mississippi, the Missouri, Rio Grande, Kansas, of the Ganges, and many other rivers, which at certain times of the year produce diarrhœa, especially in persons unaccustomed to the water.

Second. Suspended animal, and especially fœcal matters, have produced diarrhœa in many instances, such water always contains dissolved organic matters, to which the effect may be partially owing. The case of Croyden in 1854 (Carpenter), is one of the most striking on record. In cases in which the water is largely contaminated with sewage, it is important to observe that the symptoms are often markedly choleraic, (purging, vomiting, cramps, and even some loss of heat). This point has been lately again noticed by Oldekop, of Astrachan, who found strong choleraic symptoms to be produced by the water of the Volga, which is impregnated with sewage. Suspended animal and vegetable substances, washed off the ground by heavy rains into shallow wells, often produce diarrhœa, as at Prague, in 1860, when an epidemic of "catarrh of the alimentary canal" was produced by heavy floods washing impurities into the wells.

SUSPENDED VEGETABLE SUBSTANCES.

In England, and also during the late civil war in this country, instances have occurred of diarrhœa arising from the use of surface and ditch water, which ceased when wells were sunk. Assistant Surgeon Gore, of the British army, has recorded a violent outbreak of diarrhœa at Bulama, on the west coast of Africa, produced by the water of a well. The water was itself pure, but was turbid from suspended matters, consisting of the debris of plants, chlorophyll, minute cellular and branched algae, monads, polygastrica, and minute particles of sand and clay. When filtered the water was quite harmless.

DISSOLVED ANIMAL ORGANIC MATTER.

The opinion is very widely diffused that dissolved and putrescent animal organic matter to the amount of three to ten grains per gallon may produce diarrhœa.

FŒTID GASES.

Water containing much sulphuretted hydrogen will give rise to diarrhœa, especially if organic matter be also present. In the late Franco-Mexican wars the French troops suffered at Orizaba from a peculiar dyspepsia and diarrhœa, attended with immense disengagements of gas and enormous eructations after meals from the impure water.

Dissolved mineral matters, if passing a certain point, produce diarrhœa.

METALLIC IMPREGNATION OF WATER.

Occasionally animal organic matter acts in an indirect way by producing nitrates and nitrites, which act on metals.

Dr. Baedsker, a physician of Witten, and others, report cases of sickness produced by impure water. The water was found to contain a considerable quantity of copper, which seemed to be in combination with some organic matter, and the solution was aided by the large amount of nitrates which are produced by the passage of excreta into the water and subsequent oxidation.

Dysentery, also, is decidedly produced by impure water. And this cause ranks high in the etiology of dysentery. Several of the British army surgeons refer to this cause. Pringle does so several times, and Donald Munroe, in the campaigns in Flanders and Germany. In the West Indies, Lempriere, in 1799, noticed the increase of bowel complaints in Jamaica in the month of May. After floods the water was bad and turbid, "and loaded with dirt and filth." Davis (Treatise on the Walcheren Fever) mentions as a curious fact in reference to the West Indies, that ships' crews, when ordered to Tortola were invariably seized with fluxes." The dysentery at Walcheren in 1804 was in no small degree owing to the bad water. The epidemic at Guadaloupe in 1849, recorded by Cornuel, seems also quite conclusive as to the effect of impure water in causing it.

In 1860, at Prague, there were many cases of dysentery clearly traced to the use of impure water.

On the west coast of Africa (Cape Coast Castle) an epidemic of dysentery was traced by Assistant Surgeon Oakes, of the British army, to the use of impure water. That in the East Indies a great deal of dysentery has been produced by impure water is a matter too familiar almost to be mentioned.

The impurities which thus produced dysentery appear to be of the same kind as those which cause the allied condition, diarrhœa, suspended earthy matter, suspended animal organic matter, sulphates and chloride of lime, and magnesia, nitrate of lime and ammonia, etc.

AFFECTIONS OF OTHER MUCOUS MEMBRANES BESIDES THE ALIMENTARY.

Little has been done to trace out this point. At Prague, after

the severe flood of 1860, bronchial catarrh was frequent, probably caused chiefly by the chills arising from the great evaporation; but it was noticed that bronchial catarrh was most common where the drinking water was foulest, and produced dysentery.

That some of the specific diseases are disseminated by drinking water is a fact which has only attracted its due share of late years.

MALARIOUS FEVERS.

Hippocrates states that the spleens of those who drink the water of marshes become enlarged and hard, and Rhazes not only asserted this, but affirmed that it generated fevers. Little attention seems to have been paid to this remark, and in modern times the opinions of Lancisi, that the air of marshes is the sole cause of intermittents, has been so generally adopted that the possibility of the introduction of the cause by means of water as well as air, has been overlooked. Still it has been a very general belief among the inhabitants of marshy countries that the water could produce fever.

Henry Marshall (Topography of Ceylon) says the fevers of the country is attributed to the use of impure water. Dr. Bettington (Indian Annals, 1856) states that it is "notorious that the water produces fever and affections of the spleen." In the Landes (of Southwest France) the water from the extensive sandy plains contains much vegetable matter, which it obtains from the vegetable deposits, which bind together the siliceous particles of the subsoil. It has a marshy smell, and, according to Dr. Faure, produces intermittents and visceral engorgements.

At Sheerness the use of ditch water, which is highly impure with vegetable debris, has been considered to be one of the chief causes of the extraordinary insalubrity. At Versailles, a sudden attack of ague in a regiment of cavalry was traced to the use of surface water taken from a marshy district.

One very important circumstance, says Dr. Parker, is the rapidity of development of the malarious disease and its fatality when introduced by water. It is the same thing as in the case of diarrhoea and dysentery. Either the fever-making cause must be in large quantity in the water, or, what is more probable, must be readily taken up into the circulation and carried to the spleen, than when the cause enters the lungs.

TYPHOID FEVER.

The belief that typhoid fever can spread by means of water as well as air appears to be also entertained by competent observers. The fever at Gottingen in 1760 was attributed in part to the use of impure water. In 1822 Walz affirmed that an outbreak of "typhus" (typhoid) in Rhenish Prussia was caused by impure water. In 1848 Richter published an account of an outbreak of typhoid fever which occurred at Vienna, due to impure water. In 1852-3 a severe outbreak of yellow fever took place at Croydon and was

thoroughly investigated by many competent observers, and it was shown by Dr. Carpenter, of Croyden, that it was partly, at any rate, spread by the pollution of the drinking water.

In 1856 Dr. Routh published a pamphlet of cases arising from the use of impure water. In 1859 Dr. W. Budd published two very conclusive cases of this sort. In 1860 an outbreak of typhoid fever occurred at the Convent of the Sisters of Charity at Munich, traced to the use of water impregnated with much organic matter.

The propagation of typhoid fever in Bedford would certainly appear, from Mr. Simon's report, to have been partly through the medium of the water. That water may be the medium of propagating typhoid, thus seems to be proved by sufficient evidence; and it has been admitted by men who have paid special attention to the subject, as Jenner, W. Budd, Simon, and other distinguished physicians of England and France.

CHOLERA.

Dr. Muller of Hanover, Dr. Snow of London, Dr. John Marshall, Dr. Dundas Thompson, Dr. Ackland, Dr. Aitken, and many others, in papers drawn up with great logical power, the various Indian medical reports, and reports made to the British Government of outbreaks of cholera in Great Britain contained most convincing evidence that the poison of cholera may, and does, often find its way into the body through the drinking water.

YELLOW FEVER.

As, like dysentery, typhoid fever and cholera, the alimentary mucous membrane is often found primarily affected in yellow fever, there is *a priori* probability that the cause is swallowed also in this case, and that it may possibly enter with the drinking water. Boudin (*Traite de Geo., et de Stat. Med.* 1857,) quotes a case from Rochard in which a French frigate took in water at San Sago, where yellow fever prevailed. Several days after yellow fever broke out with such violence that two-thirds of the crew were attacked. "And the proof that the only cause was the water," says Rochard, "was that the persons living with the Captain had with them water from Europe, and all of these escaped."

Boudin very properly remarks that this evidence is very defective, but yet we must remember how completely the propagation of marsh and typhoid fever and of cholera has been overlooked.

The Barrack Commissioners have also directed attention to the "fact of the great impurity of the water at Gibraltar at the time of the yellow fever epidemic." Diseases of the skin, diseases of the bones, calculi, goitre eutozons, such as tape worms, the round worm, Guinea worm, I might proceed to show have all been introduced into the system by impure water, either internally or externally applied, but as I have fully established the point aimed at

in the discussion of this subject, and this article has already attained too great a length I fear, I will content myself with stating the conclusions arrived at by scientific men, and, with a few suggestions, will close :

1. An epidemic of diarrhœa in a community is almost always owing either to impure air, water or food. If it affects a number of persons suddenly, it is probably owing to one of the two last causes ; and if it extends over many families, almost certainly to impure water.

2. Diarrhœa or dysentery, constantly affecting a community, or returning periodically at certain times of the year, is far more likely to be produced by bad water than by any other cause.

3. A very sudden and localized outbreak of either typhoid fever or cholera is almost certainly owing to the introduction of poison by water.

4. The same fact holds good in cases of malarious fevers, and especially if the cases are very grave, a possible introduction by water should be carefully inquired into

5. The prevalence of intestinal worms (*lumbrici*), guinea worm or the broad tape worm should always excite suspicions of the drinking and bathing water.

I have cited authorities freely, I acknowledge, in the above statement, not only because I thought the ideas of one brought up on this sandy bluff, where, from the small size of the city, we might be supposed to have contracted views and few sources of information, but because they carry with them the essence of truth and are the well expressed views of men who have devoted time and study to their elucidation. The people, and the City Council too, ought to be informed on this subject, for the plentiful and regular supply of pure water is all-important to the health of a community. I have dealt with the sanitary, and not with the financial question of a pure and impure water supply. The mains and pipes ought to be larger, so as to convey a greater body of water to the different parts of the city. The forcing pump ought to be more powerful, but, as these are points more within the province of an engineer, and are now, I understand, under consideration by the authorities, I will say nothing more under that head. I would urge the necessity of removing the buildings and establishing basins higher up the river—a mile at least, if not more—for on a visit to the water works I noticed that the mouth of the trunk supplying the basins with water opens just above the lock of the Ogeechee canal and in the neighborhood of the Central Railroad wharf, where the garbage and refuse matter of the ships that lie there are poured into the river, as well as that carried by the tides along the whole river front of the city, contaminating the water with organic impurities in a state of solution and decomposition.

I would here also take occasion to urge a suggestion, which I am aware has been under consideration from time to time, of establishing a filtering apparatus in connection with the water works. Charcoal, for instance, might be used, and other agents to purify the water used as a drink by so many thousands of our people. The answer I anticipate—the cost; it is necessary to economise the city resources. What is money when the health of the community is concerned? Cannot a small water tax in addition to the water rates be assessed, if necessary, to carry out this important measure? If suitable hydrants or pumps with the water filtered from the water works were made, the unsightly pumps now seen about the city might be dispensed with, containing as they do much solid residue of unwholesome ingredients. (See Dr. N. A. Pratt's Analysis, *Savannah Journal of Medicine*).

Composition of River and Pump Water Compared, and calculated for 100,000 parts of the Water.

	RIVER.	PUMP.
Specific Gravity at 60°F.....	10.0005	1 0001
Residue from 100,000 grs. of Water.....	2.843	10.709
This residue consists of		
Carbonate of Lime.....	0.684	2.086
" " Magnesia.....	0.132	0.238
Chloride of Sodium.....	0.276	2 607
" " Calcium, }		0.302
" " Magnesia, }	trace	
" " Magnesia, }		0 081
Sulphate of Lime.....	trace	0.010
" " Soda, }		
" " Magnesia, }	0.332	1.933
Silicia.....	0.148	0 317
Peroxide of Iron.....	0.061	0.262
Alumina.....	0.110	0.846
Loss by Ignition, { chiefly Vegetable Matter.....	1.094	
" Ammoniacal Salts.....		2.524
Loss in Analysis.....	0.006	0.006
Total Salts.....	2.843	10.709

The above analysis of the waters of Savannah was taken in 1859 by N. A. Pratt, Professor of Chemistry, Savannah Medical College.

Published in the "Morning News," August 17th, 1881.

Comments on Ex-Surgeon General Hammond's Criticism on President Garfield's Medical Attendants.

MR. EDITOR :

I read with surprise in your issue of this morning a notice of a letter written by ex-Surgeon General Wm. A. Hammond, of New York, in which, it is said, "he takes strong ground against the course pursued by President Garfield's attending surgeons. I am no apologist for those gentlemen, nor do I intend to take up the gauntlet in their defence, as I presume they are abundantly capable of taking care of their own professional reputations. I think it remarkable that a gentleman of Dr. Hammond's professional standing, and a member of the "National Medical Association," should commit, in the first place, such a breach of professional etiquette as to arraign the President's medical attendants, among whom I see the name of the Surgeon General of the United States army, on the charge of incompetency and want of skill in the management of the President's case. in a letter addressed to a secular paper, as I understand it. His remarks might be justified if he confined his criticism to some of his medical friends and acquaintance in private, but when he writes a letter to a daily print, he not only does injustice to those gentlemen, but injures the profession at large, in my view, by bringing them before the public and exposing their mistakes, if they made any, to the public gaze. Thousands have, ere this, read his letter, and think, no doubt, what a set of asses the President must have had around him as his medical advisers. What are medical men's opinions and knowledge worth, if the President was allowed to lie a sufferer on his back for thirty-five days, when Dr. Hammond or some other astute surgeon like himself could, in the incipiency of the case, have discovered the situation of the ball, removed the fragments of clothing and of bone, and thus saved the great suffering of the President while "his strength was at the maximum, and before the track had been partially closed by the swelling of the soft parts?"

In order to get at the facts of the case I quote from the New York *Medical Record* the account first of Dr. Townshend, Health Officer of the District, who is reported to have said, "I found the President, about five minutes after the shooting occurred, in a vomiting and fainting condition. From the pulse at the wrist I thought he was dying. After administering restoratives," he goes on to say, "he (the President) rallied considerably, and I proceeded to examine his wounds, I found that the last bullet had entered his back about two and a half inches to the right of the vertebræ. I introduced my finger into the bullet wound. Some hemorrhage followed."

Besides the official bulletins, it had been stated, prior to July 4th, that the wound was located between the tenth and eleventh ribs, four inches to the right of the median line of the back; that a finger introduced into the wound had felt that the eleventh rib was fractured; that at another exploration the finger had felt the substance of the liver; that a probe had been passed in a distance of three inches. By the two latter examinations the direction of the wound was found to be downward and forward.

"On July 4th a careful analysis of the symptoms that had presented up to that date was made by Faneuil D. Weiss, D D., Professor of Practical Surgical Anatomy, Medical Department of the University of the City of New York." I will here briefly state the result of his analysis. First. A pistol wound was located between the tenth and eleventh ribs, four inches from the median line of the back. Second. Upon receipt of the wound the President fell, or rather sank down to the right side, not losing consciousness. Third. Vomiting occurred as he fell, which had continued from time to time. Fourth. Within five minutes alarming failure of heart's action occurred. Fifth. Immediate pain of right leg and foot. Sixth. Hemorrhage from wound, though not excessive. Seventh. Lowering of the temperature to 98.8 degrees Fahr. during shock. Eighth. Equable, almost normal standard of respiration. Ninth. Pulse fluctuating from slight causes. Tenth. Pains in legs and feet. Eleventh. Slight tympanitis. Negative evidence existed which seemed to exclude injury having been inflicted to either of the following parts, which would in all probability have seriously complicated the case, if not have proved fatal. No artery or vein of any considerable size was wounded; neither the lung nor pleura was injured; the diaphragm was not injured, nor the right kidney; the spinal cord was not injured, nor the ascending colon, when not covered by peritoneum. From the President's good general condition up to that time, there appeared a chance that the peritoneum and the organs invested by it—the liver, stomach, small intestine, large intestine and spleen had escaped injury. It remained to determine how a bullet, entering where the President was wounded, could escape injuring the right pleura, the

right lung, the diaphragm, the peritoneum, the liver, the right kidney, the ascending colon, the small intestine, or the spinal column, and the life of the wounded person be spared, by deflection of the bullet in such a peculiar way as to reach one or more of the nerves that contributed to the sacral plexus, and which was the cause, doubtless, of the pains in the legs and feet."

Neither time nor space will allow me to follow up the analysis of Prof. Weisse, nor will it be interesting to the majority of the readers of your paper. I will here only introduce an extract from a letter of Prof. Hamilton, one of the great guns of New York city, whose reputation as a surgeon I presume Dr. Hammond will not gainsay, to Prof. Weisse, in which he remarks: "I have from the first sought to encourage you in your present line of study, not because I had by any means *determined in my own mind* the course of the bullet, but because it seemed proper to determine anatomically all the possibilities in the case." Now, sir, we read Prof. Hamilton, an experienced, erudite surgeon, writing that he had not by any means determined in his own mind the course the bullet had taken, and that after he had seen and presumably had made satisfactory, if not a thorough, examination. It is the ground taken if not laid down by all teachers of the science and art of surgery, as well in their oral teachings as in their writings, that none of the great cavities of the body should be probed, especially in gunshot wounds of the abdominal cavity or of the head, lest, in the latter case, if the brain is penetrated by a ball, increased injury may be done to that organ. Even if the locality of the ball in the brain could be discovered, how could it be got out? In the former case, if the liver or kidney is injured, irrepressible hemorrhage might be occasioned, and if the intestines were penetrated an increased outflow of its contents might be brought about, developing fatal peritonitis. And yet Dr. Hammond has the temerity to arraign the surgeons in attendance for not making a thorough exploration of the wound, which two of them had already done with their fingers, one of them having had the whole length of his finger in the wound.

Again he arraigns them for neglect in not removing the fragments of clothing and bone, and for neglecting to extract the ball while the "strength of the patient was at its maximum." If these gentlemen were so unskillful, why did not the great New York surgeon and the great Philadelphia surgeon, the consulting surgeons, do this at their first visit to the President? No, they wait for days, if not some weeks after, when an abscess has evidently formed, and, after a great parade, while the patient was under the influence of ether, they open the abscess and discover that there was a piece of bone and a fragment of clothing contained in the abscess with the pus. And now, while they have ascertained the exact position of the ball imbedded in the muscular tissues outside

the peritoneum, they refrain from cutting down and extracting it where there are no important blood vessels, no vital organ to be injured by this surgical procedure.

My remarks being sufficiently extended, though I might say much more about the track of the ball, how it fills up, and what is the usual course of treatment in such cases, I will finish by saying that in my judgment Dr. Hammond has violated the code of ethics of the National Medical Association, and if the ball ought to be taken out so easily, why does Dr. Hammond not offer to go on to Washington and extract the ball, one cause at least of the President's continued suffering? Because it is easier to criticise at a distance than to do the right thing in the right place and at the right time.

It is extremely difficult, at times impossible, to follow up the track of a ball that has entered the body. Every surgeon who knows anything about gunshot wounds must coincide with me in this opinion. A ball entering the body will pursue a straight course, unless meeting with an obstacle sufficiently dense and compact to resist and deflect it from its true line or straightforward course. What direction it will take depends upon the angle at which it impinges upon that bone, or whatever obstacle it encounters, in its passage through the tissues of the body. A tendon has been known to do it. If a ball, then, takes another than a direct course, it is often impossible for the surgeon to tell where it has gone unless it can be felt under the surface, for no probe can be made to follow its track, unless it is known where the track lies, and the probe can be bent to follow its tortuous course. The surgeons in attendance had every reason to believe at first that the ball had penetrated the abdominal cavity, and at least had wounded the peritoneum, if nothing more, producing traumatic peritonitis, a dangerous kind of inflammation, and apt to terminate fatally.

It is reported in the daily papers that there was a discoloration of the skin over the spot which I learn is fixed upon by the surgeons as the present position of the ball, confirmed by the induction balance invented by Prof. Bell, a compound of galvanic battery and a telephone. It is claimed that this apparatus has shown, with reasonable certainty, that the bullet lies in the front wall of the abdomen, about five inches to the right and below the navel. If I understand rightly that the surgeons located the ball at that place indicated by the ecchymosis or discoloration of the skin, it is a matter of wonder to me why they did not cut down at that point and remove the ball. In this view of the case, I find fault with the attendant surgeons for not searching for the ball and cutting down and removing it, and after Drs. Hamilton and Agnew were called in why did they not do it is a point I would like to have explained. But the ball did not pursue the course indicated, in my humble

judgment, and if I may be allowed to hazard an opinion, when it struck the rib, it drove the broken fragment of bone in one direction, while it was caused to be deflected obliquely backwards as it was impelled on, and will be found somewhere on the left side of the body.

Since I commenced this communication I learn that the President has had a return of fever and alarming symptoms. If the statements are true about the course and position of the ball, I do not believe that this is the cause of his relapse, but that it is miasmatic, or as it is fashionable to call it malarial fever assailing an already weakened system, predisposed thereby to the poisoned emanations of an infected atmosphere. Gov. Blackburn's idea that the spine was injured is, I think, untenable with the light before me. None of the symptoms show it, except the pains in the feet and legs, which may be accounted for by the nerves springing from the spinal marrow and supplying the lower extremities having been injured by the ball. There would have been also paraplegia, or paralysis of the lower extremities, in all probability, if the spinal marrow had been wounded. If the surgeons had paid less attention to figuring up daily the temperature of the body, and frequency of the respiration and pulse, and spent part of that time in examining and searching for the ball, I think they would have done better. I have indulged in a little criticism myself, it is true, above, but it is only on the supposition that the information I have received is correct.

W. G. BULLOCH, M. D.,
Savannah, Ga.

