In operating one is called on to choose between a possible relapse into dorsal dislocation, and the passing of the head into anterior transposition, in case perfect replacement is not obtained. If one does not tear the adductors freely, relapse into dorsal dislocation may be the result; if one tears them too freely, anterior transposition may be the result; and if one chooses the middle ground, supracotyloid displacement may be the result. A good skiagram will be of immense assistance in helping one to a choice between not tearing and tearing freely, and in the absence of a skiagram one may judge fairly accurately by the ease with which displacement results when the limb is adducted.

I am inclined to the opinion, though it has not been proved, that other congenital defects in the child, such as clubfoot, genu-recurvatum, absent patellæ, clubbed hands, defects of the elbows and shoulders, congenital kyphosis, rupture, etc., in the patient, and congenital defects in the parents (the father of one of my patients had congenital absence of the leg), all render a perfect replacement less probable.

There can be no doubt that subcutaneous division of the long-thigh muscles would make reposition much easier in all cases and possible in some otherwise impossible cases. But to a strong and patient operator the shortened muscles do not form the chief obstacle—it is the shortened nerves and blood vessels which, when put on the stretch, give paralysis and obstructed circulation. This is illustrated by Case 112, where replacement, after preliminary weight-and-pulley stretching in bed, was easily effected in a strong-muscled girl of 9 years with three inches shortening. The circulation was cut off and the hips had to be redislocated.

On the other hand, in Case 129, a girl of 13 years, the hip was replaced after preliminary stretching and the circulation remained good, but the skiagram shows the upward displacement not great, though the shortening as shown by measurement was $2\frac{1}{2}$ inches. Some of this shortening was unquestionably due to the shortening of the femoral head and neck.

Paralysis, which is one of the possible accidents, appears to me to be due to a too severe longitudinal stretching at the time of the operation.

Tearing of the perineum need not result if a rubber pad is placed beneath the sheet that is passed between the legs and fastened to the table to give counter-traction.

In Case 79 a skiagram (Fig. 9) was made when the splint was removed, and shows anterior transposition of the operated hip and an upward displacement of the hip not operated on. I can not believe that Professor Lorenz could have overlooked this dislocation, and can only assume that it became dislocated during the period of walking with the pelvis tilted and the leg adducted to accommodate the leg in the plaster splint.

Fracture of the shaft of the femur, which happened in one of Lorenz' cases, and fracture of the neck of the femur, which happened once under Lorenz' operation, and twice under mine, seems to be due to lack of patient and deliberate manipulation on the part of the operator. Fracture of the shaft should be put up in plaster with the limb fully extended, as Lorenz did in his case. Figure 10 shows how good the result was. In fracture of the neck, I believe the limb should be put in extreme abduction for three or four weeks and then gradually brought down beside its fellow while the plaster splinting is continued. By this method one of my cases gave a good result, while Lorenz' case and my second case, treated for six or eight months in right-angled abduc-

tion, gave a permanent abduction deformity which promises the need of another operation.

NOTE:—The discussion on this paper will be found in Society Proceedings in this issue, in the report of the New York Academy of Medicine.

THE FIRST USE OF ETHER AS AN ANESTHETIC.

AT THE BATTLE OF THE WILDERNESS IN THE CIVIL WAR.*

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On previous occasions it had been my privilege to visit battlefields, and there to administer the pain-destroying agent which it pleased God to make me the human agent to introduce for the benefit of suffering humanity. How little did I think, however, when originally experimenting with the properties of sulphuric ether on my own person, that I should ever successfully administer it to hundreds in one day, and thus prevent an amount of agony fearful to contemplate.

When the news of the commencement of the Battle of the Wilderness reached Washington, the surgeon general at once said that there would be work for his corps, and for such volunteer surgeons as could be obtained. Previously notified that a requisition would be made for my professional services, I was a "minute man," and left with the first party, taking a steamer for the landing-place called Belle Plain.

I was awakened about daybreak by the clatter of hoofs and rattling of wheels. Peeping out from under my blanket I saw a four-horse ambulance, and heard the driver say to an orderly: "We have brought down General Getty, badly wounded, and must go back to Fredericksburg right away." "Now is my chance," thought I, and springing to my feet, I sought the medical director, who cheerfully gave me an order to go

* This is an abstract from an unpublished paper by the late W. T. G. Morton, M.D., of Boston, to whom the world is so deeply indebted for his early investigations of ether anesthesia. It was written soon after the Battle of the Wilderness in May, 1864, and has been furnished for publication by his son, Dr. Wm. J. Morton of New York City, by request of Dr. Henry O. Marcy of Boston. As an introduction we quote the following from the valedictory address delivered by Dr. John H. Brinton to the graduating class of Jefferson Medical College in 1892:

"Let me, from personal reminiscence, relate an anecdote in point: In the early summer of 1864, during the fierce contest in the Virginia Wilderness, I was present officially at the headquarters of Lieutenant-General Grant, on whose staff I had previously served. When in conversation with him, an aide approached and said to him that a stranger, a civilian physician, wished to see him for the purpose of obtaining an ambulance for his personal use in visiting the field hospitals. The answer of the General was prompt and decided: 'The ambulances are intended only for the sick and wounded, and under no circumstances can be taken for private use.' This response was carried as given to the waiting applicant, a travel-stained man in brownish clothes, whom at the distance I thought I recognized. I went to him and found that he was Dr. W. T. G. Morton. I asked him to wait a minute, and returned to the General. On repeating his request I received the same answer. 'But, General,' I ventured to say, 'if you knew who that man is I think you would give him what he asks for.' 'No. I will not,' he replied. 'I will not divert an ambulance to-day for any one; they are all required elsewhere.' 'General,' I replied, 'I am sure you will give him the wagon; he has done so much for mankind, so much for the soldier; more than any soldier or civilian has ever done before, and you will say so when you know his name.' The General took his cigar from his mouth, looked curiously at the applicant, and asked: 'Who is he?' 'He is Dr. Morton, the discoverer of ether,' I answered. The General paused a moment, then said: 'You are right, Doctor, he has done more for the soldier than any one else, soldier or civilian, for he has taught you all to banish pain. Let him have the ambulance and anything else he wants.' Not only this, but I have learned from a printed letter of Dr. Morton, recently sent me by his family, that the hospitalities of the headquarters—ambulance, tent, mess and servant—were afterward tendered him during his stay, by order of the general commanding."

back in the ambulance, so that I left before my professional associates were awake.

Fredericksburg is nine miles distant from Belle Plain, with which it is connected by two main roads, and just now by a score or so of avenues, constructed for existing emergencies. The country, all the way between these points, is stripped entirely bare of fences, stock and products of whatever description, and, in the entire distance, I do not remember to have seen more than six houses. Immediately back of the landing at Belle Plain a range of hills stretches away to the east in abrupt, precipitous angles, with deep ravines ribbing their sides, through which roads have been constructed, along which the immense trains climb with difficult ascent, often overturning, sometimes breaking down, utterly. On the summit of this range of hills are thick growths of low timber, while the slopes are strewn with patches of thicket—mostly of pines and scrub oak. The place is inexpressibly wild and desolate, and the only living beings visible were teamsters, wounded soldiers and mounted patrols.

In one dreary defile up came four men from behind us, and rode past at a brisk trot, two on each side. As they wore the Federal uniform, neither the driver nor myself mistrusted them, until, as if by magic, two each seized one of our leading horses, while the other two cut the reins and traces, and away they went. They were a quartette of guerillas, who thus helped themselves to a good pair of Uncle Sam's horses, leaving us to pursue our journey with a single pair instead of four-in-hand. The audacity of the rebel guerillas is astonishing, although they invariably seek unarmed or wounded subjects for plunder, and keep a wide distance from our patrols.

At last we rattled over a pontoon bridge, and entered the remains of the war-desolated city of Fredericksburg, once one of the most beautiful and flourishing places in Virginia. It is regularly laid out, the streets are shaded with trees, and although the houses are not noted for their architectural beauty, yet they are built with an idea of simplicity and of convenience which can not but charm the beholder. Nearly every house has a large garden, both in the front and rear, filled with all kinds of vines and flower trees.

At first, there was confusion and lack of supplies, causing much suffering and discomfort. But Surgeon Dalton, the efficient medical director, soon had everyone made as comfortable as circumstances would permit, and the Sanitary and Christian Commissions did their share of the noble work. Scores of volunteer nurses, state relief agents and other good Samaritans did what they could to relieve the necessities and alleviate the sufferings of these brave wounded men.

The ambulances could not have brought one-tenth part of them, and the rest were brought in wagons, eleven or twelve miles over the remains of a planked road, worn by war-travel. In places the larger wagons had to be pried out of the deep holes with trimmed trees. The delays of the entire train from this cause were frequent and long. The depth of these holes, and the instinct and habit of the lead and middle team of mules to trot away from a wagon in a sudden descent, in order to escape the whipple-trees, inflicted on the unfortunate wounded, blows and jars excruciatingly torturing and that wasted their remaining vitality. Over every rod of the way and in the best two-horse spring ambulances, a jarring motion was communicated by the absence of half the planks on the planked side of the

road, and the ruts and holes cut into the clay side during a week's rain by the transportation machinery of an army of a hundred thousand men. On such a highway, and in such a manner, did these poor fellows, who stretch their hands out of these ambulances and army-wagons for tin-cupfuls of water, painfully travel—some with arms off at the shoulder, some with legs off above the knee, some with an arm and leg both off, hundreds shot through the leg or arm or the breast, some with horrible wounds of the face—even to the loss of the jaw and the destruction of speech—all presenting, in the aggregate, every possible variety of gunshot wound.

Having been assigned quarters in a fine old mansion, I commenced going the rounds of the buildings used as hospitals, to administer anesthetics. There was at first a lack of supplies, and many of the wounded, who had been jolted over hard roads some eight and forty hours, were in a bad condition. Several hundred, packed into a church or hall, without change of clothing or washing, made the atmosphere unbearable almost, and gangrene and erysipelas began to make their appearance, but this was soon remedied.

One of the principal hospitals was the Baptist Church, which was literally packed with wounded. The tank intended for immersion was used as a bathing tub, and the operations were performed in the pastor's small study, back of the pulpit.

The Free Masons' hall was also filled with wounded, and there remains much of the paraphernalia of the lodge in which Washington received his degrees. I found one poor fellow who was a member of the fraternity, and at his request had his bed moved to the platform once occupied by the master's chair, where he lay and gazed upward at the mystic letter "G," as if secure under its protection.

It was a noteworthy fact that, although each of the great armies which met in the Battle of the Wilderness had at least 250 pieces of artillery, there were not in the hospitals at Fredericksburg a dozen men wounded by cannon shot or shell. Out of the 3,000 reported as wounded in Hancock's demand, not one had received a shot or shell wound from artillery. It was also noticed that many of the wounds received were caused by balls which had glanced from trees or rocks, inflicting comparatively slight injuries. I was informed by a division surgeon that out of about 1,000 wounded under his charge, not over thirty were permanently disabled.

By Thursday, May 12, the wounded at Fredericksburg were all well cared for. Surgeons and nurses had arrived. The Sanitary and the Christian Commissions were actively at work. All those patients who could bear transportation were being sent away, and I was beginning to think of making a visit to the front, when a summons came requesting me to hasten thither. There had been fearful fighting, as General Grant had swung around his army out of the bloody Wilderness, and he now faced Spottsylvania Court House.

Leaving Fredericksburg in company with an officer of my acquaintance, we started for headquarters. Just out of the town we passed some four or five hundred army wagons, each one with its four or six horses or mules ready for service, yet near the supplies of forage.

There were also large droves of cattle, brought from the western states for the use of the Army, and killed as they were needed. The road, if road it may be called, was wretched indeed, the horses often sinking in mud

holes to the saddle girths. Through this ambulances and wagons were floundering along, carrying the wounded to Fredericksburg, while others, only slightly injured, plodded along on foot. Occasionally we passed an impromptu camp, where these slightly wounded men had stopped to rest, and several newly made graves showed where some poor fellows had made their last halt.

It is the most sickening sight of the war, this tide of the wounded flowing back. One has a shattered arm, and the sling in which he carries it is the same bloody rag the surgeon gave him the day of battle; another has his head seamed and bandaged so you can scarcely see it, and he weaves like a drunken man as he drags along through the hot sun; another has his shoe cut off, and a great roll of rags wound around his foot, and he leans heavily on a rough cane broken from a pine tree; another breathes painfully and holds his hand to his side, where you see a ragged rent in his blouse; another sits by a puddle, dipping water on a wounded leg, which, for want of dressing since the battles, has become badly inflamed; another lies on a plat of grass by the roadside, with his browned face turned full to the sun, and he sleeps. So I passed hundreds, in riding a few miles. They move along silently, making no complaints, asking no questions and no favors of the passerby. Such heroic bravery and fortitude are only surpassed by their valor on the field of battle.

The appearance of the country along our way is calculated to make the scene all the more impressive. The two hostile armies which have occupied this part of the Old Dominion ever since the war begun, have fought over nearly every acre of this ground. Although there were fine farms and luxurious old Virginia homes along this road, not a house, not even a rail, is to be seen. Desolation seems to have marked it for her own. At long intervals the blackened walls, ruins of Virginia, stand as a ghostly record of rebellion. The plains are already grown up with wild bushes, and are fast taking the appearance of the old battlefields to which we used to make long pilgrimages with curious interest.

On reaching the top of an eminence, I at last saw our line, in the shape of a horseshoe, somewhat straightened out, with troops all around, in readiness for instant attack, while beyond them, crouched in rifle-pits, were our pickets. Riding through regiments and batteries I reached a house which had been pointed out to me as General Grant's headquarters, but found on my arrival that he had moved so that the building might be used as a hospital. Just then several wounded rebels were brought up on stretchers, and the surgeon in charge, who had known me after Burnside's attack on Chancellorsville, invited me to administer anesthetics, which I did. All of them had limbs amputated, and seemed very grateful afterward for the kind treatment which they received.

When these wounded Confederates had been attended to, the surgeon sent an orderly with me to the headquarters of the medical director of the Army of the Potomac, to whom I reported for duty, and then, as there was no need for my services, I went on until I reached the headquarters of the Army. These occupied a group of about twenty tents, pitched along the border of a piece of woodland. In front of one of these tents, the fly of which was converted into an awning, sat the lieutenant general with several officers and Mr. Dana, the assistant secretary of war.

I had been introduced to General Grant at Washington, and he at once remembered me and gave me a

kindly welcome. Had I not previously known him, I should never have dreamed that so unpretending a person was the commander of so mighty a host. He is rather undersized, compactly built, and evidently able to endure great fatigue. His sandy hair is thick and bushy, as yet not marked with gray. The barber has had nothing to do about his face since the war commenced, wherefore much of the native expression of his countenance is lost under moustache and beard. A dry, straight-cut mouth and clear gray eyes are about all that are visible. On his forehead the skin, well tanned and browned by exposure, is drawn over the frontal bone tight and smooth as a drumhead. It is said that not a wrinkle or a frown is ever seen there. It is the expression of immovable calmness. His forehead is higher and better than it appears to be, for it is concealed by coarse, bushy hair. Incessant, close and rapid thought is going on there, however quiet the external signs may be.

The general says but few words, yet he is not morose or repulsive. This reticence is not the result of misanthropy or ill-nature, for no trial of temper ruffles the calmness of his mind. No officer is more approachable. There is no general commander so ready to dispense with ceremony or the show of rank, to listen carefully and to reply plainly to the point.

I found General Meade in excellent spirits, and he gave me the agreeable intelligence of a brilliant success which had been achieved that morning, "before breakfast," as he expressed himself. Before day, General Hancock ordered a slow advance of his line of battle in the direction of the line of intrenchments held by Ewell's corps, who were in his front. Slowly and surely did his men creep forward and the dawn of day found them close on the sleeping and unsuspecting rebels.

The firing amounted to little or nothing; there was no time or necessity for such work. The shelter tents of the enemy, erected near their line of entrenchments, were entered by our troops before the rebels had time to escape from them; they were surrounded, cornered, hemmed in and fairly dumbfounded, and on the command being given to surrender they at once dropped their arms and became passive, resistless prisoners of war.

The artillery had not time to limber up and get away or fire a single volley before our dashing troops were among them. Even their general, whose quarters were somewhat in the rear, could not escape, and he, together with the greater portion of his command, became subservient to the orders and commands of the redoubtable Hancock. The prisoners taken numbered between six and seven thousand, including two generals, and some thirty pieces of artillery were also captured. This was the first battle of Spottsylvania Court House. After having narrated the morning's work, as he called it, General Grant suggested to me that it would be well to visit the scene of this sanguinary contest.

Although the rain fell in torrents, I followed his advice, and witnessed a scene which was horrible enough to curdle the blood of the coldest. The angle of the works at which Hancock entered, and for the possession of which the savage fight of the day was made, is a perfect Golgotha.

In this angle of death the dead and wounded rebels lie, literally in piles—men in the agonies of death groaning beneath the dead bodies of their comrades. On an area of a few acres in rear of their position lie not less than a thousand corpses, many literally torn to

shreds by hundreds of balls, and several with bayonet thrusts through and through their bodies, pierced on the very margins of the parapet, which they were determined to retake or perish in the attempt. The one exclamation of every man who looks on the spectacle is: "God forbid that I should ever gaze on such a sight again."

On Saturday morning, May 14, I was awakened by the booming of cannon, and learned that the enemy were endeavoring to regain their lost position. After a hasty breakfast, I began to visit the field-hospitals, to produce anesthesia where capital operations were to be performed. The wounded were brought to these field-hospitals by the newly organized ambulance corps of their respective divisions. When there was any heavy firing heard the ambulance corps, with its attendants, stationed nearest to the scene of action, started for the wounded. The ambulances were halted near by, and the attendants went in with stretchers to bring out the wounded. The rebels did not generally fire on those wearing the ambulance badges.

On the arrival of a train of ambulances at a field-hospital the wounds were hastily examined, and those who could bear the journey were sent at once to Fredericksburg. The nature of the operations to be performed on the others was then decided on, and noted on a bit of paper pinned to the pillow or roll of blanket under each patient's head. When this had been done I prepared the patients for the knife, producing perfect anesthesia in an average time of three minutes, and the operators followed, performing their operations with dexterous skill, while the dressers in their turn bound up the stumps. It was surprising to see with what dexterity and rapidity surgical operations were performed by scores in the same time really taken up with one case in peaceful regions. When I had finished my professional duties at one hospital, I would ride to another, first arranging at what hour I would next return. In the garden of one house used as a hospital I noticed over twenty lifeless and mangled forms, bloody and ghastly—men without heads, heads without bodies, hands wanting arms. Some had died with fierce expressions on their faces; others who passed quietly from the stormy shores of time to the realms of eternal peace. The dead are buried where they fall, or near the hospitals in which they die. Their names are carefully written on wooden headboards, and entered into registers.

Early on the morning of Wednesday, May 18, the whizzing of shells announced that the second and great battle of Spottsylvania Court House had been commenced. It was four o'clock a. m. when the Union skirmishers advanced. The rebels were there, armed and vigilant. Both sides opened with cannon. Smoke and mist hung pale, heavy and motionless over the troops. On the right was Gibbons' First division. The Irish Legion had just joined them. They had seen some service on the Blackwater and Nansemond rivers, near Suffolk, during the investment of that place by Longstreet, but had never known the reality of a battle.

On the right, the Irish Legion charged with a fierce, wild shout. Two hundred yards of clear field had to be traversed before the first line of the enemy's breastworks could be reached; a battery of four brass pieces played on our men incessantly as they advanced on a double quick. All this time the sharpshooters were busy; sufficient light was lacking to enable them to sight their pieces with precision, but many an officer owes his death to their marksmanship.

At last the field is crossed. The distance was short—only two hundred yards. Who does not believe it seemed a lifetime to many of those men, who, with bent body and erect bayonet, won their perilous way, foot by foot, through whistling balls, bursting shells, gnawing grape. The rebels fly from the first entrenched line. Our brave fellows clamber over cheerily and capture a few dilatory sharpshooters, who lingered too long at their post. About midway between the first and second parallels, the line of the legion grows confused—their pace waxes slow by degrees, and finally halts, preparatory to breaking—to retreating.

They did fall back a short distance, but the veterans of the old First and Second divisions were at hand. They took no notice of confusion, and heeded the driving bullets no more than a pelting rain. Through the pines they ran, with fixed bayonets, searching in vain for the rebels. A shout rent the air, and the second line of breastworks was won. The rifle pits in front were those which had been abandoned by us; but they were filled with rebel sharpshooters, who were soon dislodged and driven through a second line and behind a thick and impenetrable abattis, which was of a most formidable character. On examination it was deemed best not to attempt charging through this barrier, and the troops fell back in good order, although exposed to a galling fire of shell and canister from both flanks.

The sun went down red. The smoke of the battle of more than two hundred thousand men destroying each other with villainous saltpeter through all the long hours of a long day, filled the valleys, and rested on the hills of all this wilderness, hung in lurid haze all around the horizon, and built a dense canopy overhead, beneath which this grand army of freedom was preparing to rest against the morrow.

On Thursday, May 19, I learned confidentially that General Grant intended to swing around toward Richmond, and I determined that I would swing around toward Washington, where imperative business before Congress demanded my presence. Before leaving I rode with a friend along the entire front of the Union line, an undertaking that at any time before would have been attended with too much peril to make the excitement compensate for the personal risk it involved. The life of our soldiers in intrenchments affords a theme on which a chapter might be written. I could with difficulty imagine that a few hundred yards only intervened between them and a foe as impassable as it is unyielding. Here were groups of officers chatting, writing letters and reading, and all along were privates making and drinking coffee, card playing and talking over the incidents of the late battle through which they had passed thus untouched by rebel bullet or shell. But all were ready to spring in an instant to musket or cannon.

From a house used as a signal station, and with the aid of a powerful telescope, I could see the enemy's works, a battery of sixteen guns, commanding the very place where I stood. These were only a small portion of the artillery they had posted and waiting for us. Their first line of works was firmly sodded on the outside, showing that it had been built for some time. At intervals were fox or rifle pits for sharpshooters. The line in our immediate front was a mile and a half long, and formed the arc of a circle. Behind this were two other lines, mainly under cover of woods. A captured rebel officer says that after the battle of Gettysburg from fifteen to twenty thousand men were employed constructing these works,

and others between here and Richmond, to cut off any approaches, in the future, of our army on their capital. The chosen position was on a commanding ridge, and to the right and left densely wooded, leaving an open field in front over which they doubtless hoped General Grant would advance to attack them. But the general chose instead to make a flank movement rather than to lose thousands by an assault. Leaving the front on Friday, May 20, to return to Fredericksburg, I passed train after train of ambulances and wagons laden with the wounded, some groaning and writhing in anguish, but none complaining.

I saw at Fredericksburg a number of our wounded, left behind in the Battle of the Wilderness, but brought in by a detachment sent after them. Never were a set of men more rejoiced than were these poor sufferers on seeing our men come to rescue them. They had been left with a few surgeons and attendants, and supplies for a number of days, but some roving squad of rebel cavalry who came in shortly after our departure, helped themselves freely to sugar, salt, hard tack and whatever else they wanted. Had our poor men been left there a day or two longer they must have died of starvation.

Some time after the arrival of the squad above mentioned, Hampton's Legion of cavalry arrived, and its commanding officer promptly placed a guard over the hospitals and declared nothing more should be taken, yet his men took all the sugar and coffee they could find in the haversacks of dead or wounded. Dr. Armstrong, of the Eleventh Virginia cavalry, dressed the wounds of our men, and showed them great kindness, for which act of humanity his name deserves honorable mention.

I found Fredericksburg as I had left it—one vast hospital. But during the week of my absence great changes for the better had been made. Wounded men arriving covered with dust and blood, weary and faint, were placed in the hands of the nurses in the wards they were to occupy; their tattered garments, as they often are, removed, the purifying and soothing application of a warm bath made, the wound is examined and ministered to by the surgeon in attendance, and, arrayed in clean and suitable apparel, the patient was placed gently on a hospital couch with bedding well aired and clean. The process was similar in the case of all who were brought in. There is no crowding, no confusion. Each ward had its designated number of occupants, its number of nurses—one nurse being usually assigned to ten men, while the surgeons had from eighty to a hundred patients assigned as the complement of each. This arrangement secured good and sufficient attention to the patients in all cases where those having charge showed ordinary intelligence and fidelity.

The patients appeared cheerful and patriotically happy. A shot in the arm, or leg, or side, or shoulder, had prostrated many of them. Sometimes a bandaged brow or jaw suggested a tale which told itself, and occasionally a woefully attenuated form spoke of wasting illness. But almost every occupant of the long rows of beds was in the very best of spirits, cheerful in the memory of duty done, and exultant in the prospect of that which is to be consummated. What was particularly noticeable in these soldiers was their modesty in speaking of themselves, their generosity in mentioning their comrades. They could scarcely be brought to dwell on their own exploits and disasters, and reverted with the brave fondness of military devotion to those of the men with whom they had battled side by side. These soldiers of the Union

are as enduring on the sick bed as they are valiant in the field. They do not whine nor grumble.

General Grant having decided to evacuate Fredericksburg, the wounded were removed to Washington in steamers. . . . The scene at the Washington wharf was a painfully interesting one. The high bluffs commanding a view of the landing were thronged with women and children, all in attitudes of expectation and anxiety. The entrance to the gangway was similarly beset. The gangway itself was lined with groups inquiring for friends or relations, or administering to the wants of wounded soldiers. At the end of the wharf long tables were spread with such refreshments as might be required by the suffering men, and ladies and gentlemen in the service of the Sanitary Commission busied themselves in ministering to their wants. As a general rule, the wounded bear their sufferings with almost stoical firmness. Hardly a groan was heard as they were borne along the wharf on stretchers to the ambulances, although the nature of the wounds of many must have rendered the least movement extremely painful.

Time will not enable me to describe the scores of hospitals in and around Washington, where tens of thousands of unflinching heroes have received and are receiving the nation's choicest care. The minister of the gospel, the surgeon, the philanthropist and the devoted loyal women of the metropolis vie with each other in giving their time to these wounded soldiers. The poor fellows receive tender nursing, watchful guardianship by day and by night, and all the kindly ministrations that gratitude and affection can suggest.

The hospital heroes, suffering as they do, do not lead a blank, complaining life. The invalids arranged along the extensive vistas of the wards, sprinkle with numberless jokes the surface of serious conversation. Each, in spirit at least, "shoulders his crutch and shows how fields were won." Some of the wounds reported as slight are fearful enough to make the patient wince and the beholder shudder. The budding spring is too green and pleasant, the air too golden and balmy, to be in complete accordance with a scene like this. The windows and doors are wide open, and the gentle breeze streams through. The blue of the sky and the green of the meadow are mutually harmonious in beauty, and it is this which makes us feel there is such a dissonance between the scene without and that within.

As to the hospital fare, concerning which complaints are sometimes made through the papers, perhaps not always without reason, the wants of the invalids are certainly provided for, as far as may be, in a wholesome and substantial way. Luxuries and various delicacies are not to be looked for, of course.

Plain vegetables, such as potatoes, turnips, cabbage and onions, are furnished, with good bread, and, if obtainable, good butter, rice, hominy, milk, tea and coffee, fresh beef, soups, bacon, with eggs, chicken, and custard or pudding occasionally for extremely delicate palates. Many hospitals, indeed, have a less varied bill of fare than this, particularly at certain seasons of the year, when several of these articles are scarce and to be procured only at great pains and cost. But most well-managed hospitals can point to such a variety as evidence of the liberal provision made by the government for those who have been disabled in its service. In addition to this the ample stores of those grand voluntary agencies, the Sanitary and Christian commissions, are freely opened to the constant applications made by the hospitals in behalf of their inmates. These commissions fur-

nish to the sick a great variety of articles which the government does not furnish. Jellies, canned fruits, jams, domestic wines, cordials, lemons, may serve as a sample of the various provision flowing to stanch the soldier's wounds and soothe his sorrow, from the inexhaustible fountain of sympathizing hearts at home. Warm garments to cheer him in winter, light, loose garments to promote his ease and comfort in summer, reach the soldier to gladden him, from the same source. Indeed, this love to the poor soldier, gushing forth still buoyant, tireless, irrepressible in these grand benefactions from countless home circles over the land, forms one of the sublimest spectacles of the day. It is a mighty power, too, in this struggle, that is doing more at this moment to strengthen the government and make its trying work successful, than any amount of brute force with all "war's dreadful enginery" to back it.

While I have endeavored to describe to you the mighty struggles of the Wilderness and of Spottsylvania Court House, I have also desired to demonstrate that the wounded soldier is well cared for. Countless home circles from which the young, and noble, and tenderly-endearred have gone forth in the cause of an imperiled country, may be relieved from the anguish of feeling that their loved ones, prostrated by bullet or disease, are left unregarded or without proper care and attention, to bleed, languish and die. The government has guarded with anxious vigilance against all this. Its paternal care has taken, all over the land, the form of a beautiful system of means and appliances aiming at the relief, comfort and healing of the maimed and war bruised. And the soldier's kin and friends may feel and know, and take comfort as they do so, that if the fate of war should number their most cherished ones among the hosts whom sickness seizes or bullets pierce, they will find on the hospital couch the ministry of kind and skillful hands to soothe and mitigate their pangs, and, if God will, win them back to health.

For myself, I am repaid for the anxiety and often wretchedness which I have experienced since I first discovered and introduced the anesthetic qualities of sulphuric ether, by the consciousness that I have thus been the instrument of averting pain from thousands and thousands of maimed and lacerated heroes, who have calmly rested in a state of anesthesia while undergoing surgical operations, which would otherwise have given them intense torture. They are worthy of a nation's gratitude—happy am I to have alleviated their sufferings. For the dead heroes we mourn—but let all the patriotic benevolence, and science, and philanthropy of the republic be brought into requisition for the benefit of the wounded.

THE INTRACELLULAR TOXIN OF BACILLUS PYOCYANEUS.*

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The object of this research was to ascertain whether or not *Bacillus pyocyaneus* contains an intracellular toxin. Some years ago Buchner obtained from this organism a large quantity of a pyogenetic proteid. He took the germ substance from potato cultures, rubbed it up with water and then treated it with about fifty vol-

umes of a 0.5 per cent. solution of caustic potash. This formed in the cold a mucilaginous mass, which dissolved at the temperature of the water bath and after being heated for several hours was filtered and acidified with acetic or hydrochloric acid. The acid threw down a precipitate, which was collected, washed with water, and was injected subcutaneously into animals. It was also placed in sterilized spindle-shaped glass tubes, and introduced under aseptic precautions under the skin of rabbits. After from two to three days the tubes were removed and found to contain, in addition to some of the proteid, several cubic millimeters of fibrinous pus, which proved to be sterile.

In 1889, Charrin and Roger, working with *Bacillus pyocyaneus*, made the experiments which may be said to be the starting point of all subsequent work on agglutination. These facts made it desirable to ascertain whether or not this organism contains an intracellular toxin.

My own work may be summarized as follows: Pure cultures were grown in the large tanks used in this laboratory, and after fourteen days, the germ substance was removed from the agar, precipitated with alcohol, collected on a hard filter and extracted with alcohol and ether. The toxicity of the germ substance for guinea-pigs is shown in Table 1.

TABLE 1.—THE TOXICITY OF THE POWDERED GERM SUBSTANCE OF BACILLUS PYOCYANEUS WHEN INJECTED INTRAPERITONEALLY INTO GUINEA-PIGS.

Protocol Number.	Weight.	Amount Injected, mg.	Results.	Hours.	Proportion of Toxin to Body Weight.
1	215	43.00	+	12	1 to 5,000
2	250	50.00	+	12	
3	230	23.00	+	12	1 to 10,000
4	190	19.00	+	12	
5	290	14.50	+	12	1 to 20,000
6	190	9.50	+	12	
27	180	4.50	+	12	1 to 40,000
28	195	4.86	+	12	
21	200	4.44	+	12	1 to 45,000
22	245	5.44	+	12	
7	250	5.00	+	12	1 to 50,000
8	230	4.60	+	12	
17	220	4.40	+	12	
18	210	4.20	+	12	
15	240	4.36	—		1 to 55,000
16	230	4.18	—		
19	235	4.27	+	24	
20	240	4.36	—		
23	180	3.00	—		1 to 60,000
24	215	3.54	—		
13	190	3.166	—		
14	265	4.401	+	24	
25	210	3.23	—		1 to 65,000
26	305	4.69	+	24	
11	210	3.23	—		
12	220	3.384	+	12	
9	315	4.20	—		1 to 75,000
10	260	3.466	—		

It will be seen from Table 1 that the powdered germ substance of *Bacillus pyocyaneus* is surely fatal to guinea-pigs when injected intraperitoneally in the proportion of 1 part to 50,000 parts of body weight.

When injected subcutaneously in guinea-pigs, even in as large a quantity as 1 part of the toxin to 10,000 of body weight, the only inconvenience that resulted was a slight swelling at the point of inoculation, followed by temporary loss of weight. Subcutaneous injections did not give immunity to subsequent intraperitoneal treatments.

These results show that the toxin is not destroyed, although it is slightly diminished at the temperatures given in the tables.

* This paper and the two which follow are from a series of studies of bacterial cells, research in the Hygienic Laboratory of the University of Michigan, 1903.