From Ruysch's cabinet. Note the pathetic pose of the fœtal skeleton at the top. He is playing left-handed with an injected artery as a bow on a sequestrum as a violin. Note also the feather borne by another to the left; the coils of intestine (probably his own) by a third to the right, who also holds in his other hand an injection of the pampiniform plexus; the vesical vase to the extreme left; the touching symbolism of the recumbent skeleton and its butterfly; and the rockery of calculi interspersed with arterial and other injections. Ruysch's Thesaurus Anatomicus, III. Amstel. 1703.

ADDRESSES

AND OTHER PAPERS

BY

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PREFACE.

These occasional addresses and other papers are published in the hope that they may prove useful both to the profession and to the public and in response to numerous requests.

I trust that a few repetitions will be forgiven inasmuch as the audiences were different and the facts important. Of course the statistics and allusions to current events must be read as of the date when the addresses were originally delivered and not of the date of the present volume.

I have to thank the Editors and Publishers of the various periodicals and books in which some of the papers first appeared for permission to republish them.

William W. Keen.

Philadelphia, *May* 8, 1905.

CONTENTS.

THE EARLY HISTORY OF PRACTICAL ANATOMY.*

IN welcoming you here this evening, gentlemen, at the beginning of the winter session,—and welcome you I do with the sincerest pleasure,—it has occurred to me that in no way could we spend a pleasanter hour than in reviewing the early history of practical anatomy. We shall see in the difficulties that attended its beginning, and the improvements that have been gradually introduced, how much better off we are than were our predecessors, and how zealously we should avail ourselves of these advantages.

The life and labors of Vesalius have been so often and so fully discussed that you have readily at hand the means of acquainting yourselves with them. I shall not, therefore, enter into these in detail, but only allude to them when necessary. But Vesalius, who was born in 1514, although the real father of anatomy, was by no means the first who practised human dissection. If we wish to see its starting-point, we must go back to ancient times. We must retrace our steps to the third century before Christ, and transfer ourselves from the amphitheatre of Padua to that of Alexandria, to

* The Introductory Address to the course of lectures on anatomy at the Philadelphia School of Anatomy, Tuesday, October 6, 1874. This was originally given as the Introductory to the course of 1870, and was then printed. The edition was soon exhausted, and by request was repeated and reprinted in 1874 with corrections and additions. The address is reprinted from the edition of 1874 with the kind permission of J. B. Lippincott Company.

discover the bold innovators who first forced the dead human body to disclose its secrets for the benefit of the living.

Two centuries earlier still, Democritus and Hippocrates had taken the first tentative steps, in the examination of the bodies of the inferior animals, but they ventured no further than this.

It is in Alexandria, three hundred years before Christ, that we meet with the first human anatomists, Herophilus and Erasistratus; and they are said to have been such zealous cultivators of the new science that they not only dissected the dead human body, but even the living, in order to search for the hidden springs of life itself.* It is curious to note how this belief that anatomists were addicted to ante-mortem dissection has not been peculiar to Egypt, but has pervaded all lands and all times. Vesalius was shipwrecked and died when fleeing for his life on a similar charge.† The Edinburgh Act of 1505, giving the surgeons the body of one criminal annually "to make an anatomie of," was guarded by the proviso, "after he be deid,"‡ and even Staupa, a medical man, in his book on dissection, published so late as 1827, gravely advises the student to assure himself that the body is "really dead."§ Even poetry has lent its aid to perpetuate the legend of the "Invisible Girl," whose ghost was be-

* Biographie Médicale par ordre chronologique, par MM. Bayle et Thillaye, Paris, 1855, tome i, p. 40. This charge of Tertullian is reasonably accounted for on the ground that such rumors would naturally attach themselves to the first dissectors of the human body. It is stated that Cocchi, in his De Usu Art. Anat., Florence, 1736, has vindicated them from the charge. Surgeons, however, not infrequently have been allowed to test operations on criminals, who were pardoned if they survived. Galen thus operated in cases of nerve wounds, and Paré, Colot, and numerous other surgeons, in cases of lithotomy.

† Bayle et Thillaye, op. cit., tome i, p. 231.

‡ Prof. Struthers's Hist. Edin. Anatom. School, Edin. Med. Journ., Oct. 1866, p. 289, note.

§ Hyrtl, Handbuch der Zergliederungskunst, pp. 51, 52.

From the first edition of Vesalius' Anatomy (1543).

lieved to haunt Sir Charles Bell's anatomical rooms, where she had been dissected alive on the night preceding that appointed for her marriage.*

* See Gibson's Rambles in Europe, pp. 143–44. The poem does not follow the legend as to the dissection's being ante-mortem. In Hood's

"GIN A BODY MEET A BODY."

Whims and Oddities the title is "Mary's Ghost." Gibson wrongly entitles it the "Invisible Girl." I have given the original text, which differs slightly from Gibson's, and I add, also, Hood's original wood-cut.

MARY'S GHOST.

1.

'Twas in the middle of the night
  To sleep young William tried;
When Mary's ghost came stealing in
  And stood at his bedside.

2.

Oh, William, dear! Oh, William, dear!
  My rest eternal ceases;
Alas! My everlasting peace
  Is broken into pieces.

3.

I thought the last of all my cares
  Would end with my last minute,
But when I went to my last home,
  I didn't stay long in it.

4.

The body-snatchers, they have come
  And made a snatch at me;
It's very hard them kind of men
  Won't let a body be.

But the example of Alexandria in the cultivation of anatomy aroused no imitators—no rivals. For several centuries Egypt was the only medical centre of the world. Anatomists of every country resorted thither, and in the second century after Christ we find Galen compelled to go from Pergamus to Alexandria in order to see a skeleton. Even in Rome itself, and as court physician at a later period, Galen could dissect nothing but the lower animals. The burning of the dead by the Romans prohibited totally any attempt at anatomy, and, instead of sending his students to Egypt to study anatomy, he sent them to Germany to dissect the slain among the national enemies, while he contented himself with the ape.*

This feeble light at Rome and Alexandria, however, was soon extinguished, and human dissection disappeared from history for twelve centuries. The twilight of the well-named

5.

You thought that I was buried deep,
Quite decent-like and chary;
But from her grave in Mary-bone,
They've come and bon'd your Mary.

6.

The arm that used to take your arm
Is took to Dr. Vyse;
And both my legs are gone to walk
The hospital at Guy's.

7.

I vow'd that you should have my hand,
But fate gave us denial;
You'll find it there at Dr. Bell's,
In spirits and a phial.

8.

As for my feet, the little feet,
You used to call so pretty,
There's one, I know, in Bedford Row,
The t'other 's in the city.

9.

I can't tell where my head is gone,
But Dr. Carpue can;
As for my trunk, it's all packed up
To go by Pickford's van.

10.

I wish you'd go to Mr. P.
And save me such a ride;
I don't half like the outside place
They've took for my inside.

11.

The cock, it crows—I must be gone!
My William, we must part!
But I'll be your's in death, altho'
Sir Astley has my heart.

12.

Don't go to weep upon my grave,
And think that there I be;
They have'nt left an atom there
Of my anatomie.

* Hyrtl, Lehrbuch der Anatomie des Menschen, 8te Auflage, Wien 1863, p. 230. William Hunter's Introductory Lectures, p. 24.

Frontispiece to the first edition of Vesalius' Anatomy (1543), showing animals used in dissection, as well as the human body.

"Dark Ages" had set in, and when, in A.D. 640, the vast treasures of the Alexandrian library were burned, night itself came on. So long and so deep has that night been in the very natal city of human anatomy that it is but six years since the death of Clot Bey, the first public lecturer on anatomy in Alexandria for about seventeen hundred years; and so strong are Mussulman prejudice and hatred, that, although under the protection of the Pasha Mehemet Ali, when he first opened the thorax of a body a student rushed upon him and stabbed him with a poniard. The blade slid over the ribs, and Clot Bey, perceiving that he was not seriously hurt, took a piece of plaster from his dressing-case, and, applying it to the wound, coolly observed to the class, "We were speaking, gentlemen, of the disposition of the ribs and sternum, and I now have the opportunity of showing how a blow directed from above has so little chance of penetrating the thorax," and went calmly on with his lecture.*

The Mohammedans, into whose hands medicine passed at the fall of Alexandria, wholly abandoned dissection, and, as we have just seen, had even the fiercest prejudice against it, based on its prohibition by the Koran and the seven days' ceremonial uncleanness it denounced against all who even touched a dead body. Galen's anatomy of the ape reigned supreme till the time of Vesalius, in 1543. Even then the substitution of the lower animals for man was neither wholly nor easily overthrown. In Paris we find Sylvius, the teacher, and afterwards the fierce opponent of Vesalius as an innovator, lecturing "from small fragments of dogs."† The ape was preferred by many on account of its outward resemblance to man, but swine were the favorites,‡ because, being omnivorous animals, they still more closely resembled the hu-

* Medical Times and Gaz., Sept. 9, 1868.

† Morley's Life of Jerome Cardan, vol. ii, p. 100.

‡ Hyrtl, Zerglied., p. 28. Text and note.

man race, "especially," says Hyrtl, with one of his usual sly thrusts, "certain individuals among them." Vesalius himself so far yielded to the popular fancy that some of his descriptions are drawn from this very source, and the frontispiece of his anatomy, in the first edition (1543) and later ones, show a number of apes, goats, and dogs. In 1627 Spigelius similarly honors the swine*; and even so lately as the middle of the last century William Hunter tells us that "the operations of surgery were still explained to very little purpose upon a dog."†

But with the rise of the Italian universities came the first gleams of light. Bologna, the oldest of them all, is in many respects the most famous. Founded in 1088 as a school of Roman law, the fame of her professors was such that, as early as 1262, no less than ten thousand students were gathered there.‡ The faculties of medicine and of arts were founded before the fourteenth century, and soon added to her fame. Here, two centuries before Vesalius was born, the first dissections of modern times were made. In 1315, Mondini, or Mundinus, publicly dissected two female bodies,§ and established what was intended to be an annual custom, but which, strange to say, was soon neglected. Bologna, the first in the new era of medicine, has not since then been behind her rivals in the healing art. The names of Carpi, Vesalius, Arantius, Malpighi, Valsalva, Varolius, and Galvani alone are enough to make her famous. But she was also the earliest exponent of one of the great questions of the present day in medical as well as other circles. Her female professors have rivalled

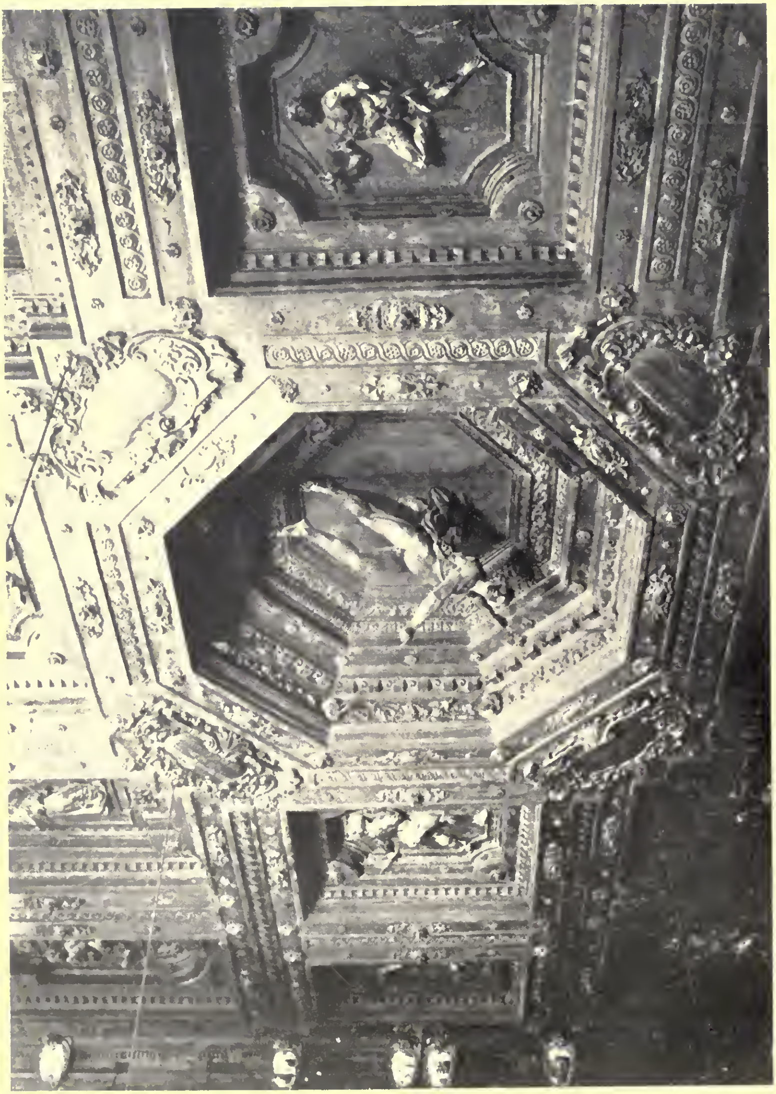
* Hyrtl, Zerglied, p. 28. Text and note.

† Introductory Lectures, p. 88.

‡ Encyc. Britan., vol. xxi, p. 449. In the fourteenth century there were thirteen thousand. Paris had at one time as many as thirty thousand.

§ New Am. Cyc., first ed., article Anatomy, i, 519. Encyc. Brit., eighth ed., article Anatomy. Curiously enough, William Hunter, in his Introductory Lectures, does not mention Mondini, but traces modern anatomy back only to Leonardo, and says he was the first to go even thus far back.

The Anatomical Theater in Bologna in which the first modern dissections were made in A. D. 1315 by Mundinus. Among the other professors of anatomy in Bologna who presumably lectured in this room were Carpi, Vesalius, Arantius, Malpighi, Valsalva and Varolius, as well as a woman professor of anatomy, Madonna Manzolina. Probably Harvey attended lectures here.



The ceiling of the Anatomical Theater in Bologna.

their male associates in distinction. In medicine she has even had a professor of anatomy, Madonna Manzolina, and, in 1865, I saw in the museum preparations made by her that would do credit to our own times.* In 1732 Laura Bassi was made doctor of laws and lecturer on philosophy, and in 1817 the immediate predecessor of that astonishing linguist, Mezzofanti, in the Greek chair, was Matilda Tambroni. In the fourteenth century we find Novella d'Andrea, the professor of canon law†; and such was her beauty that she had a curtain

> "Drawn before her,
> Lest if her charms were seen, the students
> Should let their young eyes wander o'er her,
> And quite forget their jurisprudence."

Yet notwithstanding the fame given to the Bolognese School and the impulse given to anatomy by the teaching of Mondini, the science retrograded, and all the Italian schools declined. The time of renovation had not yet arrived. The school of Salernum, which had been the most famous for several centuries, mourned by Petrarch, even passed out of existence.‡ The dark ages were not yet over. Boccaccio laments that when visiting the library of the celebrated monastery of Monte Casino, near Naples, he found the doors gone, grass growing in the windows, and the precious books

* Those who wish to pursue the subject of women in medicine further will find much of interest in the following: Lipinski, Histoire des femmes médicales, Paris, 1900; Schelenz, Frauen im Reiche Aeskulap's, Leipzig, 1900; and Baudouin, Femmes médecines d'Autrefois, Paris, 1901. (W. W. K., 1905.)

† Encyc. Brit., vol. xxi, p. 451.

‡ Frederick II (Charles II? 1285–1309), of Naples, prohibited surgeons from practising unless they understood the "anatomy of the human body, without which one cannot perform any operation, nor direct the cure after having done it." Malgaigne's edition of Paré's works, Introd., p. xxx. Did they then dissect? I can find no record of it; yet this would suggest it strongly.

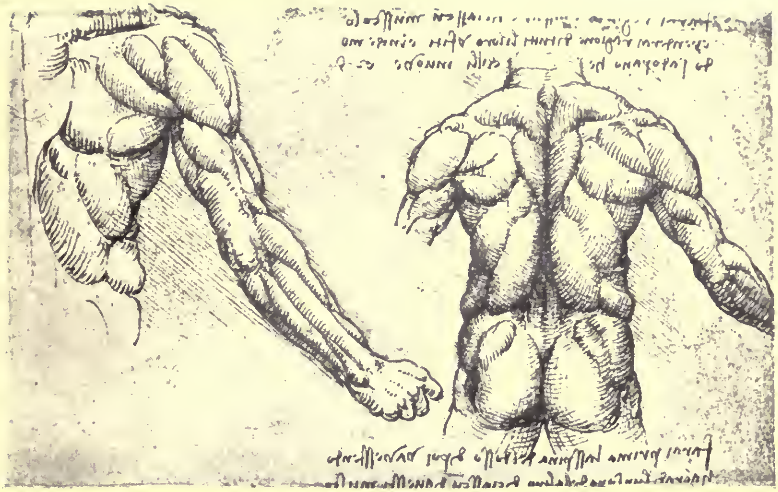
and manuscripts yet undestroyed covered with dust and mold.*

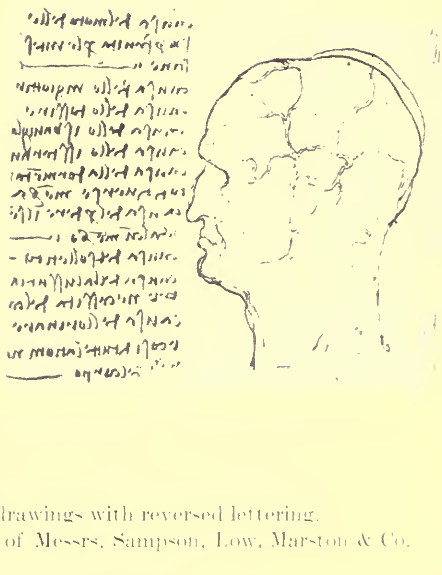
From Mondini to Vesalius the best anatomist of his age was undoubtedly Leonardo da Vinci, the great artist. Not only did he dissect the horse and other inferior animals, but also the human body. From these dissections he made his celebrated sketch-book of drawings in red chalk, now in the British royal collection at Windsor, and labelled by him with reversed letters, so that they have to be read by a looking-glass.†

But now came the revival of learning early in the sixteenth century. That wonderful awakening of the human mind which was manifested in the discovery of America, of the passage to the East Indies, and of the Copernican system, and in the invention of printing, of the compass, and of gunpowder, could not but find a new path of progress in medicine as well. Vesalius took the lead in 1537 as a teacher of genuine anatomy in Padua, and in 1543 he published his splendid work which soon revolutionized the science. A host of anatomists followed in his path. Columbus, Eustachius, Fallopius, Fabricius, Gasser, Ingrassius, Arantius, Vidius, Varolius, and others, all diligent anatomists of the sixteenth century, have left their mark in the household names of elementary anatomy. I say elementary anatomy advisedly, for the first dissections were both naturally and of necessity confined to the grosser, ocular parts of the body. The bones, muscles, and viscera were almost the only well-dissected and well-described parts, and if we except Vidius and his perplexing "Vidian nerve," none of the anatomists just mentioned have their names associated with any of the finer parts. For such mi-

* Malgaigne's Paré, Introd., p. xlvii.

† Wm. Hunter, Introd. Lect., pp. 37–39, and R. Knox, M.D., Great Artists and Great Anatomists, London, 1852, Leonardo. It is understood that these sketches will soon be published. Many autotype reproductions of other sketches by Leonardo have been published by Braun, of Dornach, and they amply attest his wonderful knowledge of anatomy.





Three of Leonardo Da Vinci's drawings with reversed lettering.
From Richter's da Vinci, by permission of Messrs. Sampson, Low, Marston & Co.

nuter investigation gross anatomy had first to clear a path. Bodies also were too few, and had to be too hastily dissected; and their instruments were too imperfect. The dissecting-forceps, without which no minute dissection could be carried on, is not certainly over one hundred and fifty years old, and may be far less.* Not to speak of modern pictures representative of practical anatomy, Rembrandt's famous painting in the Hague, about two hundred years old, represents Van Tulp demonstrating the muscles with our ordinary surgical dressing-forceps. This awkward substitute, together with double hooks on a handle,† and the fingers were then the anatomist's only resources. Moreover, no good means had as yet been devised for preserving bodies for more prolonged and delicate dissections, nor for injecting the vessels, nor for making permanent preparations, whether for reference or for teaching; and models were undreamed of. Discouraged by many as a useless innovation; frowned upon by others as repugnant to our better feelings; obstructed by the law; treated even as impious; fostered only by the love of knowledge and by its own necessity, the science found few cultivators among the bulk of the profession.

Among the teachers of anatomy it was not infrequent, but outside the lecture-room no dissecting-rooms existed. Students saw the demonstration, and that was all. None of them dissected for themselves. Nor when we come to later times do we find the case rapidly bettered. The first Monro says that in his student days, *early* in the last [eighteenth] century, his Scotch anatomy was limited "to seeing the dissection of the human body once in two or three years."‡ In William Hunter's time, at the *end* of the same century, practical anatomy was unknown to the mass of the profession

* Hyrtl, Zerglied., pp. 19 and 20.

† See them figured in Michael Lyser's Culter Anatomicus, Amstel., 1653.

‡ Edin. Journal, Oct., 1866, Hist. Edin. Anat. School.

until he established the celebrated Great Windmill Street School. In 1866 we find Professor Struthers, of Aberdeen, saying, "Less than a generation ago it was not an uncommon thing to find medical practitioners who had never dissected."* And even to-day, after considerable personal experience as a teacher of anatomy, I have grave doubts whether the majority of our students dissect the human body more than once.

But, in spite of these obstacles, anatomy, both descriptive and practical, went on gaining favor with both its teachers and the profession at large.

Italy, the focus of the arts and sciences in the revival of Greek learning, naturally took the lead. In her celebrated universities professorships of anatomy were founded early in the sixteenth century, and her schools were crowded with hundreds, and even thousands, of students from all parts of Europe, who returned to their native cities, carrying with them patriotic desires for the advancement of science in their own lands.†

England was among the first to profit by the shining example. Soon after the founding of the Royal College of Surgeons in 1540, through the influence of Dr. Caius, the king's physician, and the founder of Caius College, Cambridge, Henry VIII granted to the Royal College of Surgeons the privilege of dissecting four felons annually, and in 1564 Elizabeth gave the same privilege to the Royal College of Physicians.‡ In 1581 the latter college created the lectureship on anatomy, and in 1583 built in Knight Rider Street the first anatomical theatre. Here, in 1615, Harvey was elected lecturer, or, as it was then

* Edin. Journal, Oct., 1866, Hist. Edin. Anat. School.

† From 1204, when the University of Vicenza (the first after Bologna) was founded, to 1445, eighteen universities were founded in Italy alone, and thirteen more in other parts of Europe, to which thirteen others were added before the year 1500.

‡ The Gold-headed Cane, pp. 91, 92.

called, reader, in anatomy, and here he gave his first public demonstrations of the circulation of the blood about a year later.*

The facilities for general medical dissection, however, were very limited, and, as if to discourage it still further, in 1745 a fine of £10 was imposed on anyone dissecting outside of Barber-Surgeons' Hall. But such a state of affairs could not long exist. The profession, under the lead of William Hunter, soon broke away from such bonds, and for over half a century almost every distinguished anatomist had dissecting-rooms attached to his private dwelling, where he and his pupils cultivated the science. In 1770† William Hunter bought a lot in Great Windmill Street, London, opposite the Haymarket, and built on it a dwelling-house, an anatomical theatre, dissecting-rooms, and a museum. The lecture-room was lighted from above, and the seats rose as in our own amphitheatres. Here he lectured, assisted by his brother John, by Hewson, and by Cruikshank, till his death, in 1783. Here he collected his splendid museum, now in Glasgow, at a cost of £100,000,‡ and his brother John began his own collection, which cost him before its completion £70,000,§ and now forms the chief ornament of the Museum of the Royal College of Surgeons. At William Hunter's death the anatomical school passed into the hands of his nephew, Baillie, and then successively to Cruikshank, Wilson, Sir Benjamin Brodie, Sir Charles Bell, and Shaw, and finally to Mayo and Cæsar Hawkins. On Mayo's removal, in 1833, to University College Hospital, this celebrated school came to an end.‖ But it

* The Gold-headed Cane, pp. 95–98.

† William Hunter began his first course of Anatomical Lectures, however, on Feb. 1, 1746. Tweedy's Hunterian Oration, Lancet, Feb. 18, 1905. (W. W. K., 1905.)

‡ Brodie's works, vol. i, p. 448.

§ Life of John Hunter, p. 72.

‖ For these and other interesting particulars as to this celebrated school, had left its mark. Thousands of educated anatomists had gone forth from its walls to practice all over Great Britain and in this country. It furnished William Hunter's museum to Glasgow in 1807, and John Hunter's to the Royal College of Surgeons, London, while, later still, those of Wilson and Sir Charles Bell went to ornament the museum of the Royal College of Surgeons of Edinburgh, and that of Mayo to University College, London. From it as a foster-mother, too, along with the institution of new public schools connected with the hospitals, many other private schools sprang up, and presented the finest opportunities for the diffusion of anatomical knowledge, so that in 1825–26, besides the hospitals, there were no less than seven such private schools of anatomy in London.*

Next to England in point of time, Holland was the foremost in cultivating anatomy in its modern revival. Ruysch, Swammerdam, Albinus, and Boerhaave, in the last half of the seventeenth century, were not only the anatomical lights of their own country, but also of all Europe, and especially of Germany through Haller, and of Scotland through the Monros.

I have already quoted the Edinburgh Act of 1505, which allowed of the annual dissection of a criminal, and also the early experience of the first Monro, which shows how rarely this was made available. The first Scotch anatomical theatre was built, and the first public demonstrations given, in 1697. But it was not till 1720 that a regular professor was appointed. At that date Monro primus was elected Professor, at the extraordinary salary of £15 per annum! From this time till 1859, when Monro the third died, the history of Edinburgh

see Letter from Sir B. Brodie to Dr. Craigee, in Appendix to Thomson's Life of Cullen; Pichot's Life and Labors of Sir C. Bell; Wm. Hunter's Introd. Lects., Lect. 2d, and fol. papers; John Hunter's Life, and Life of Hewson.

* Lancet, 1825, pp. 26 et seqq., gives a list of them all.

anatomy, and that of this astonishing family, are almost identical. True, John Bell and Knox, Charles Bell, Barclay, Innes, and others lectured in private schools; but the Monros held the sceptre. All of them lived to old age, Alexander primus dying at seventy, Alexander secundus at eighty-four, and Alexander tertius at eighty-six. All were professors early in life; at twenty-three, twenty-one, and twenty-five, respectively. All of them taught for long periods: thirty-eight, fifty-four, and forty-eight years; and father, son, and grandson, they held the anatomical chair in Edinburgh from 1720 till 1846, a period of one hundred and twenty-six years!*

In view of the fact that this, our own, city was only founded in 1682, it shows unusual vigor and enterprise that in 1751 —less than seventy years after it was a wilderness—Dr. Cadwalader, a pupil of Cheselden, in London, gave demonstrations in anatomy in Second Street above Walnut. Eleven years later, Dr. Shippen, Jr., a pupil of the Hunters, became a regular lecturer, and the founder of the medical department of the University of Pennsylvania. The following is his announcement in the "Pennsylvania Gazette" of November 25, 1762: "Dr. Shippen's anatomical lectures will begin tomorrow evening at six o'clock, at his father's house, in Fourth Street. Tickets for the course to be had of the doctor, at five pistoles each, and any gentlemen who incline to see the subject prepared for the lectures, and learn the art of dissecting, injections, etc., are to pay five pistoles more." His Introductory was delivered in the State House, and his class numbered twelve. Three years later his house was mobbed for alleged violation of the church burying-ground, an assertion which the doctor denied in a public announcement, and at the same time declared that he had only dissected the bodies of "suicides, executed felons, and now and then one from the Potter's Field."†

* Edin. Journal, Oct., 1866, Hist. Edin. Anat. School.

† Carson's History Med. Dept. Univ. Penna., pp. 39, 40, 80–81, and Ap-

Dr. Shippen was not alone in this misfortune, for Monro was mobbed in 1725, Macartney in Dublin many years after, and Sir Astley Cooper and others have barely escaped it, besides all the fights and riots in which students and resurrectionists have been involved. These troubles point to a difficulty which from the dawn of practical anatomy has always been felt. The problem how to obtain a sufficient knowledge of anatomy and yet not to do violence to the feelings of the community is one difficult of solution. Had all anatomists been even so gallant as Riolan, physician to Louis XIII, who dissected females only on couches of germander, daphne, clematis, and thyme, and entombed them in their floral beds,* yet the difficulty would not have been overcome. The problem was only solved by the anatomy acts which were passed in England in 1832,† on the continent at various periods some years before, and in this country by Massachusetts in 1831‡ and New York soon after.§ But these acts were only obtained after the community had been driven to it, not only by the repeated violations of the public peace and public feelings, but also by repeated crimes.

When a student with Sylvius in Paris, Vesalius had to prowl around the places of execution and spoil the gallows of its victims, and to retain his booty was sometimes obliged

pendix, p. 217. For many other interesting facts in the early history of anatomy in this country, see Prof. A. B. Crosby's address before the New Hampshire Medical Society (1870).

* Riolan's Enchiridium, quoted by Hyrtl, Zerglied., p. 31.

† For this act, known as the Warburton Act, see the Lancet, 1831–32, p. 713.

‡ For copy, see Am. Journ. Med. Sci., vol. viii, 1831, p. 264.

§ The Pennsylvania Anatomy Act was passed in 1883. It is, I believe, the best in the United States. Under its provisions we have now an ample supply of cadavera, while its provisions carefully prevent wounding the sensibilities of the community. For the full text of the Act see Medical News, Aug. 11, 1883, p. 167, Pamphlet Laws of Penna., 1883, p. 119; and with an amendment in Purdon's Digest, vol. i, p. 106.

to hide the bodies even in his own bed.* The more enlightened, though cautious rulers and legislative bodies, soon provided a partial supply. The first recognized source, and until the present century the only legal one, was from executed criminals—an illustration of which may be seen in Hogarth's "Reward of Cruelty." But Cortesius tells us about 1600, that so jealously guarded was this privilege (in Messina) that in twenty-four years he could but twice dissect a subject, and then under great difficulties and in great haste.† What a contrast to the five thousand now annually dissected in Paris alone!‡

In England it was not till the reign of George II, in 1726,§ that *all* criminals, instead of a few, were given for dissection. This act was in force till 1832, but this source of supply was insufficient even when executions were more frequent than now. In all Great Britain, from 1805 to 1820, there were executed eleven hundred and fifty criminals, or about seventy-seven annually; and at the same time there were over one thousand medical students in London and nearly as many in Edinburgh. The result was a natural one. The grave-yards were rifled; and, as the demand was a permanent one, there arose a set of the lowest possible villains who provided a permanent supply—the resurrectionists—a race of men now happily almost extinct.

At first but few in number, they soon rapidly increased, till in 1828 there were in London over one hundred regular resurrectionists,‖ besides many occasional volunteers; and their trade was so extensive that, if the police were more than usually vigilant in Edinburgh or Dublin, they would supply those more distant schools. Their skill was such that

* Morley's Life of Jerome Cardan, vol. ii, p. 11.

† Hunter's Introd. Lect., pp. 41–42.

‡ Hosp. and Surgeons of Paris, by F. C. Stewart, pp. 144, 145.

§ 9 George II, cap. 31, Lancet, 1834–35, vol. i, p. 356.

‖ Lancet, 1828–29, p. 793.

no obstacle was insuperable. The police watched the grounds —they were either bribed or made drunk; relatives replaced them—but a half-hour's unwary slumber on the part of the weary watcher was enough for an adept; high walls were built—they scaled them; spring-guns were set—they sent women as mourners to the funerals, who discovered the position of the pegs; a stone, an old branch, a blade of grass laid on a newly-made grave was made to act as a detective—but the practised eye of a regular would detect it in a moment, and replace it after the theft. So skillful were they that Sir Astley Cooper, in his evidence before the Parliamentary Committee, declared that no matter what the social position of any person in England, he could obtain his body if he desired it*; and such villains were they that, for a respectable price, they would unhestitatingly make a subject of him, their best though unwilling patron. The laws against their crimes, and the vigilance of the police, had but one effect—not to stop the trade, but only to increase the cost of subjects.† The ordinary charge was from £7 to £10 apiece, but often this was largely increased. In 1826 the price was as high as £16 to £22; and sometimes when the police were unusually vigilant, even £30—$150—were paid for a single subject!‡ Their avarice was unbounded. Stimulated by the jealousy and rivalry of the various schools, they usually demanded a special fee at the beginning and the end of every session; and so necessary were they, that they were often paid as high as £50 to £60 in these special fees. In case anyone was imprisoned, his bail was paid, and often, also, an allowance

* Life of Sir A. Cooper, vol. i, p. 407.

† So inadequate was the supply, that a serious proposal was made to import the subjects from France to Ireland. Lancet, 1826–27, p. 80.

‡ Lancet, 1826–27, vol. ii, p. 80; and 1828–29, vol. i, pp. 434 and 563; 1837–38, vol. i, p. 589. Life of Sir A. Cooper, vol. i, pp. 361, 396, 397, 403. Some of the resurrectionists died rich. See A. Cooper's Life, vol. i, pp. 416–418.

of ten shillings per week was paid him while he was in jail. In one case recorded by Bransby Cooper, this was continued at least during two years.* But when any subject was specially desired by an enthusiastic anatomist, then was their carnival of extortion. In 1783, when O'Brien, the Irish giant (whose skeleton, eight feet four inches high, now adorns the Hunterian Museum of the Royal College of Surgeons), was in failing health, John Hunter sent his servant Howison to watch the disposition of the remains. This fact unfortunately coming to the knowledge of the patient, in his unbounded horror of the surgeon's scalpel he ordered that after death his body should be watched day and night till a leaden coffin could be made, in which he should be taken to sea and buried there. Soon afterwards he died, and the watchers were set. Howison, having discovered the tavern where they refreshed themselves when off duty, soon struck a bargain with one of them, that if his companions would agree to it, the body should be stolen at night, and for their consent the watchers were to receive £50. The others, satisfied with all but the price, demanded £100, which Hunter agreed to pay. Finding him so eager, they soon made other difficulties, and again and again increased the price until they had raised it to £500! Accordingly, the body was stolen at night, conveyed in Hunter's own carriage to his dissecting-room, and immediately prepared, but with such haste, for fear of interruption, that the bones could never be properly whitened.†

O'Brien's coffin was not the only one which contained what might be called a "foreign body" when the clergy performed the burial service. Such thefts became a regular part of the trade, and if a night intervened between the finding of a body and the holding of a coroner's inquest, the body was liable to

* Sir A. Cooper's Life, pp. 360–362 and 369.

† Otley's Life of John Hunter, pp. 106, 107, in Palmer's Ed. of Hunter's Works, London, 1835.

2

disappear, and the resurrectionist often attended the inquest to see the astonishment of the jury. Sometimes they picked up cases of apoplexy in the street, carried them to one of the hospitals as relatives of the patient, claimed the body after death, and quickly assuaged their grief with guineas from the anatomical school of another hospital. Patrick, one of the most celebrated of the gang, for some months carried on successfully the ruse of claiming relationship with dying men and women, whose names he ascertained, in the various workhouses, and his career was only cut short by the jealousy of a rival named Murphy, who denounced him to the authorities. But Murphy himself adopted a similar plan on another occasion. Observing one day, while walking, a neat meeting-house with a paved burial-ground, in which was a trap-door, he soon returned in a suit of solemn black, seeking a quiet sanctuary for the remains of his wife. Descending into the vault to select the place of her repose, while the back of the sexton was turned he quietly slipped the bolts of the trap-door, and that very night, entering the vault by this means, he rifled every body there of the teeth, which, as porcelain teeth were then unknown, he sold to the dentists at a net gain of £60. Once, a body stolen from the grave was sold to Lizars, in Edinburgh, and paid for; was re-stolen from Lizars's dissecting-room the same night and sold to Knox; the scoundrels netting £25 in all, and without the possible fear of indictment, least of all for their second theft!

Sometimes adventurous students carried the plunder home in hackney-coaches, and this gave rise occasionally to amusing adventures. On one occasion, the hackman, aware of the illegal nature of his passenger's baggage, having arrived opposite the Bow Street police headquarters, thrust his head in at the window, and said to the uneasy occupant, "The fare, sir, to the hospital is a guinea, you know, unless you wish to be put down *here*." "Quite right, my man, drive on," was the unhesitating reply.

Along with the debasing qualities necessarily developed by such an occupation, came also some of the more enviable qualities of body and mind. Thus, on one occasion, when a party of medicals, headed by a noted Edinburgh surgeon, were discovered in a city churchyard, the chief actor laid hold of two large adults, just disinterred, and, carrying one under each arm, escaped into the garden of a private institution under the stimulating fire of blunderbusses. But strategy and adroitness, combined with brute force, were still more frequently called into play. A country lad, whose disease was peculiar and his skeleton much desired, had been buried in an exposed cemetery, in a fishing village on the Firth of Forth, and watchers were set. The resurrectionists, in full force, attempted to bribe them, to outwit them, to entrap them, but all to no avail. Weeks passed by, and the excitement was gradually dying out, when, one evening, at dusk, two well-dressed gentlemen, smoking their cigars, drove up in a dog-cart to the little inn and alighted. The whip-hand gentlemen told the hostler that he expected a livery servant to bring a parcel for him which was to be placed in the box. In a short time the parcel was delivered, and presently the two gentlemen returned and departed. The sharp-eyed stable-boy could not help remarking that the livery servant who brought the parcel "was deuced like the off-side gentleman," and fancied he saw a bit of scarlet lining under his brown overcoat. "Haud yer tongue, Sandie," said his superior: "ye're aye seeing farlies." While the gentlemen were driving away, the watchers were approaching the grave, and, to their utmost astonishment, it had been despoiled. Liston, the Edinburgh surgeon, and Crouch, the London resurrectionist, needed but thirty minutes for such work, especially by daylight. All the detectives were put upon the track, and all the dissecting-rooms searched, but in vain. Years afterwards, skeleton No. 3489, with the donor's name attached, was added to the noblest anatomical collection in Britain.*

The bodies were generally left in the night in bags, and this gave them occasionally a chance too good to be lost. They bagged drunken men on the street and delivered them as subjects, sometimes to their great astonishment, at others with their connivance. Mr. Clift, the curator of the Hunterian Museum, was once thus waked up while a student with John Hunter, and two bags delivered and paid for on the spot. The men had gone but a few steps when Mr. Clift perceived the swindle, and, though in his night-clothes, he ran after them, collared the principal, and said to him, "You've left me a live man." "I know it," said the man, shaking off his hold and escaping with the money; "you can kill him when you want him."†

But such a degrading occupation necessarily debased the men to the level of committing any crime. The increasing number of students leading to a growing demand for subjects, and the increased vigilance of the police adding to the difficulty of procuring them, the fears of medical men that murder would be resorted to were soon realized. In 1827 the University of Edinburgh, with nine hundred students in its class, for the first time made dissection compulsory, and thus greatly stimulated the demand. London, Liverpool, and Dublin all in turn supplied the want, but the prices obtained soon gave rise to the horrible crimes of Bishop,‡ in London, and William

* These details, and many others equally interesting and amusing, may be found in the account of the Resurrectionists, in the Life of Sir Astley Cooper, vol. i, pp. 334–448, and in Lonsdale's Life of Robert Knox, the Anatomist, pp. 47–116. The comic side of the subject may be seen in Hood's Jack Hall (Jackal), in his Whims and Oddities.

† The late Prof. S. H. Dickson informed me that he had this not uncommon "Joe Miller" of the present day from Mr. Clift personally.

‡ I found this man's crimes alluded to several times in the Lancet, 1832–33, vol. i, pp. 244, 341, 568, when first preparing this lecture; but, notwithstanding the most thorough search, I was unable to obtain any of

Burke, in Edinburgh, the latter, from the atrocity of his crimes, being made eternally infamous by giving his name to the crime of "Burking."

His trial, twenty-four hours long, one "of unexampled length," said the judge, in curious contrast to our more tardy justice, took place December 24, 1828. After his conviction he made a confession of all his many crimes. While he and his mistress, Helen McDougall, were lodging with a man by the name of Hare, one of the lodgers died owing Hare £4. They took the body to Dr. Knox, and sold it for £7 10*s*. Finding it so profitable, the three then proceeded to smother every available lodger who fell into their hands, and, in the year that elapsed before their detection, sixteen persons had thus been murdered. Burke was executed Jan. 28, 1829, and, by order of the judge, like Anton Probst in this very city, was publicly dissected.* His skeleton is in the Anatomical Museum of the University of Edinburgh,† and from his tanned skin John Arthur, afterwards janitor to Prof. John Goodsir, had made a tobacco-pouch, which he carried for many years as a memento of the period when he first became connected with the dissecting-room.‡

Such crimes called public attention to the imperative necessity of a proper source of supply for dissecting material.

the particulars, save that he and a man named Williams murdered an Italian boy, and were betrayed by Hill, the dissecting-room porter at King's College. Since then, Dr. J. F. Clarke has published his Autobiographical Recollections of the Profession. In this entertaining book (pp. 100–104, and the Medical Times and Gazette, March 11, 1871) a full account of the facts is given. A curious bit of history is added in the London letter of the Philadelphia Medical Times of May 17, 1873, p. 524, showing how the murderers were detected by the sagacity of the late Mr. Partridge.

* Lancet, 1828–29: his trial, pp. 424–431; his confession, pp. 667, 668.

† Lonsdale's Life of Knox, p. 76, note. This book contains a very full account of the careers of Burke and Hare, and their relations with Knox.

‡ Goodsir's Anatom. Memoirs, vol. i, p. 163,note.

The Warburton anatomy bill accordingly was enacted August 1, 1832, giving all unclaimed bodies, under proper regulations, to the various schools. This has been the model for all subsequent acts, our own passed but six years ago among them. For several years there were loud complaints as to its operation, but experience gradually removed its difficulties, and now it supplies all the schools well, and at moderate prices. The price in Edinburgh at present is $3 per part.* Our own act is suffering the same trial. Obstinacy and knavery are combined to defeat it, but I do not doubt that in the end it will gain the victory, and afford us an ample supply worthy of a great medical centre.†

Not only, however, do we have an immense advantage in these days over the so-called good old times in the facility of obtaining material, but also our means of pursuing practical anatomy are vastly more perfect and more prolific.

In the Museum of the Royal College of Physicians the curious observer will notice "six tablets or boards upon which are spread the different nerves and blood-vessels, carefully dissected," removed from the body and dried. "In one of them the semilunar valves of the aorta are distinctly to be seen." ‡ Such are the, to us, wretched preparations with which Harvey illustrated his lectures on the circulation, and they were probably used before his royal patron when he demonstrated his wonderful discovery to Charles I. He

* Really the price of a "part" in Edinburgh is but 6*s*. ($1.50), but the body is divided into ten parts—two each to the head, the thorax, and the abdomen, and one to each of the four extremities. The body lies on its back for three days to give time to have the thorax and abdomen opened and examined, and the perineum dissected; then on its belly, for dissection of the muscles of the back and then of the spinal cord. Each man next removes his own extremity, and dissects it separately.

† See foot note page 14.

‡ Harlan's Gannal's Hist. of Embalming, p. 258, and the Gold-headed Cane, pp. 127, 128. Similiar preparations are in the College of Surgeons, purchased in Padua, by John Evelyn, made by Fabritius Bartoletus, then Veslengius's assistant, and afterwards physician to the King of Poland.

made them probably at Padua, under the eye of Fabricius, the re-discoverer of the valves in the veins.* If anyone compares them with *our* splendid preparations and models, how insignificant they seem! But they were among the first essays in a new art whose benefits are still felt by all medical students.

Carpi,† Etiennes,‡ and Eustachius,§ in the sixteenth century, and Malpighi,|| Glisson,¶ and Willis,** in the seventeenth had used air, water, milk, ink, and other colored fluids, with which to inject and trace the vessels. In Holland, however, the first substantial progress was made. De Graaf, about 1668, improved the syringe, and injected mercury into the

* Charles Etiennes (Carolus Stephanus) was the first who properly understood the valves in the veins. He speaks of them (in his De Dissec. part. Corp. Humani, Paris, 1545, quoted in Hyrtl's Zerglied., p. 585, note) as "apophyses membranarum" which obviate the danger from regurgitation. This anticipates by two years Cananus, who, in 1547, when Fabricius was but ten years old, demonstrated the valves in the azygos veins. Aiken's Bibl. Med., Harvey, p. 312, and Bayle et Thillaye, op. cit., i, p. 234.

† Professor, in Pavia and Bologna, 1502–27. He is the first who speaks of injections, when treating of the renal vessels "per syringam aqua callida plenam." Isagoga brevis in Anat. Corp. Hum., Bonon., 1522, in Hyrtl, Zerglied., p. 585.

‡ He blew air into the veins by a metal tube. Hyrtl, Zerglied., p. 585.

§ Portal (Hist. de l'Anatomie, Paris, 1770, tome i, p. 634) says that Eustachius injected "fluids of various colors and densities."

|| Malpighi used ink and other fluids assiduously, and by them made various discoveries in the kidney and elsewhere.

¶ Glisson injected the liver with ink. Hyrtl, Zerglied., p. 586. Portal, iii, 261.

** Willis injected the brain with "aqua crocata." He discovered the "Circle of Willis" by this means. The tubes of Bellini in the kidneys were discovered in a similar manner. The pains anatomists took at that time were so great that a preparation by Hildanus (A.D. 1624) is said to exist in Berne, which exhibits the entire venous system dissected out by means of their distension by air, and the hundreds of ligatures that it would require. Hyrtl, Zerglied., pp. 586, 587.

spermatic vessels.* Swammerdam, Ruysch, and Albinus, however, really created and diffused the knowledge of the art of injections. Swammerdam saw that in order to fulfill its purpose the material used ought to be injected as a fluid and yet solidify in the vessels, and not evaporate as water did. He first used suet; in 1667 he substituted wax, and in 1672 he sent to the Royal Society a preparation thus injected.† His success was such that in his best preparations he filled even the arteries of the skin of the face. Two years later he gave up anatomy as impious, joined the party of a religious fanatic, and died in 1680.

Before relinquishing his profession he made his method public in Amsterdam, Paris, and London, and gave special instruction to his friend and fellow-townsman Ruysch, who pushed the art so far that he was said to believe that the body was almost wholly made up of vessels.‡ Leeuwenhoek, another citizen of Leyden, had fortunately just at this time invented, or rather made really available, the microscope, § and thus Ruysch was enabled not only to inject finer vessels directly, but also to discover, as a result of his injections, networks of vessels hitherto unsuspected.|| His first trials

* Encyc. Brit., vol. ii, p. 761. Portal, Hist. de l'Anat., tome iii, pp. 220, 221, 261. Strangely enough, Hyrtl (Zerglied., p. 587), who is usually so exact, attributes the first mercurial injections to Nuck, whose work (Adenogr. Curios., Leydæ, 1692) was published twenty-four years later than De Graaf's "De Usu Siphonis."

† Portal, Hist. de l'Anat., iii, 334.

‡ This erroneous belief (totum corpus ex vasculis) was really held by Ruysch and nearly all his contemporaries. "Antoine Ferrein," says Sprengel (Hist. de la Méd., tome iv, p. 338), "was the only one who advocated the parenchyma of the organs against Ruysch and Malpighi." It was long held by Boerhaave's school also.

§ Magnifying lenses of rock crystal were found in the palace of Nimroud, by Layard. The compound microscope was invented by Hans Zansz, spectacle-maker, at Middleburg, Holland, in 1590. Encyc. Brit., 8th ed., art. Microscope, p. 801.

|| He discovered the vasa vasorum, the bronchial arteries, the vessels

Portrait of Frederic Ruysch.

were made on the bodies of infants, but finally, when, in 1666, Admiral Berkeley was killed and his body captured in the memorable four days' fight between the English and the Dutch fleets, Ruysch successfully embalmed his body by order of the States General, and sent it back to England with an almost natural appearance.* Such was his success,† says M. Fontenelle, that he seemed not to preserve men after death, but rather to prolong their life. At the close of his long career they remained perfectly preserved, with their original softness, flexibility, and color.

In his museum, which was called the eighth wonder of the world, the *dulce* and the *utile* were elegantly combined. Flowers, ornamental shell-work, and rarities worthy a royal cabinet were interspersed with skeletons, injections, and other anatomical pieces (see Frontispiece), and many of them, especially the fœtal skeletons, were labelled with appropriate and instructive mottos.‡ Thus, one who did not attain to

of the middle layer of the choroid, called the "Tunica Ruyschiana" (though this was first accurately described by Zinn, in 1755), the finer vessels in the serous and synovial membranes, the pia and dura maters, the corpora cavernosa, and many parenchymata. Hyrtl, Zerglied., p. 594. Sprengel, Hist. de la Méd., tome iv, pp. 144, 233, 277, 278.

* Bayle et Thillaye, op. cit., vol. i, p. 528. Portal, Hist. de l'Anat., tome iii, p. 262. So natural was one infant's body that Peter the Great is said to have kissed it.

† Hyrtl (Zerglied., p. 597) found the process described by J. Ch. Rieger (Introd. in notitiam rerum natural. et artefact., etc., Hagæ, 1743, 4to, 2 vols.) under "Animal" (vol. i) and "Balsamus" (vol. ii, pp. 54–57). The latter contains a copy of Ruysch's autograph directions as to his mode of injection and preservation. The following are extracts: "Pro materie ceracea sumendum *sebum*, et quidem tempore hyemali simplex—æstivo tempore exiguum frustum *ceræ albæ* addendum. Liquefactæ materiæ additur cinnabaris factitiæ quantitas sufficiens, aut quantum vis, idque movendo, donec bene permixta sit cinnabaris. *Liquor* meus est *spiritus*, e vino, vel frumento confectus, cui si addere velimus in destillatione manipulum *piperis nigri*, eo acrius penetrat per carnosa spartes."

‡ Bayle et Thillaye, op. cit., vol. i, p. 529. The plates in Ruysch's Thesaurus Anatomicus, i–vi, Amstel., 1701, illustrate these quaint, but withal artistic, arrangements. See opposite plate.

even uterine maturity holds an inflated bladder aloft, and teaches us the shortness of life in its motto, "Homo Bulla,"—"Man but a bubble." Another holding a preparation of the lymphatics showing their valves, which had been made twenty-five years before, and not long after their first discovery by Aselius, in 1622, reminds you they are "as difficult as beautiful." A third, a uterus containing a fetus, hints at a questionable paternity: "Quo minime credis gurgite piscis erit,"—"Fish may be found in least suspected pools." A still-born child's motto, "Hæc mihi prima dies, hæc mihi summa fuit,"—"This my first day was my last," reminds one of the laconic epitaph in a similar case—

"If I was so soon to be done for,
What was I ever begun for?"

And the head of a noted woman of Leyden, whose finger points to the syphilitic perforations of her skull, has the warning motto, "In similar waters similar fish are found."* The museum was the admiration of all distinguished men at home and abroad. Generals, ambassadors, princes, and even kings delighted to visit it, and spend whole days with its author.† Peter the Great, when in Holland, in 1698, thus divided his time with Leeuwenhoek and Ruysch: he attended the lectures of the latter, and became an earnest student of medicine. He always carried a small surgical case. He learned to draw teeth, to bleed, and to dissect. So enthusiastic a pupil did he prove that he always occupied the front seat, and during one of the lectures he leaped up and was about to seize the scalpel the master held.‡ The Tsar's surgical

* Ruysch, Museum Anatomicum. An Appendix to his Opera Omnia Anat. Med. Chirur., 4to, Amstel., 1721, pp. 110, 158, 156, 173, 174, and 163, respectively. (In the Library of the College of Physicians of Philadelphia.)

† Portal, Hist. de l'Anat., tome iii, p. 262.

‡ Life of Peter the Great, London, 1832.

Ruysch's Museum.

operations, however, did not prove so successful, for a Dutch merchant's wife whom he tapped died soon after, but the Tsar, by way of consolation, attended the funeral. On his return to Leyden, in 1717, he purchased Ruysch's museum for 30,000 florins, and sent it to St. Petersburg. Ruysch, though seventy-nine years old, immediately went to work on another. When his son, his efficient assistant, died, in 1727, he pressed his two daughters into the work, and so diligent had he been that after his death, in 1731 (æt. ninety-three), his second museum was sold to Stanislaus, King of Poland, for 20,000 florins.*

* These are the statements generally made as to their disposition on the authority of Burggræve, Précis de l'Hist. de l'Anat., Gand, 1840, pp. 295, 296. Hyrtl states (Zerglied., p. 592, note) that Heister asserts in the Preface to Vater's Museum Anat. propr., Helmst., 1750, that the second museum was bought by Fred. Aug. I, Elector of Saxony, from Ruysch's heirs, and carried to Dresden. Fred. Aug. II sent it to Wittenberg, and Vater, Ruysch's pupil, then Professor of Anatomy in the University, made a catalogue of it (Regii Mus. Anat. August. Catal. Univ. Vittebergæ, 1736). Haller (Bibl. Anat., tome ii, p. 43) says of this collection: "Aliquæ partes corp. hum. ex Ruyschii thesauris coemtæ, aliqua undique collecta."

The question is often asked, "What became of Ruysch's preparations?" Conflicting statements are made, some stating they exist at the present day in perfect preservation. (Bayle et Thillaye, vol. ii, p. 85, Parson's Anat. Prep., Pref., p. v.) I am glad, therefore, to be able to give so valuable an opinion as that of Prof. Hyrtl, which, being founded on personal observation, is both interesting and decisive. He says (Zerglied., pp. 592, 593):

"Ruysch's fame outlasted his collections, and the many preparations which he expected to preserve, 'per liquorem suum balsamicum æternos in annos,' no longer exist. In the Leyden Anatomical Museum Prof. Halbertsma showed me a planta pedis which it is thought was injected by Ruysch. In the Greifswald Museum I saw two others which, it is asserted, are Ruysch's injections. They came from Vater's private collection (Mus. Anat. prop. above). The preparations sent to him by Ruysch (with whom he was in uninterrupted relations) are especially noted as such. After Vater's death the collection passed into the hands of his successor, Langguth, and at the dissolution of the University of Wittenberg was bought by an apothecary *for the glass!* By him a part was sold to Prof. Schultze, in Greifswald, when travelling through Wittenberg. In the Museum at Prague, also, I found three small preparations—an injected

What in Ruysch's time was a profound secret is in our day a common art. By the help of many workers in the same field* our means of injection are greatly increased, and our results, though to the eye they do not reach those popularly ascribed to Ruysch, yet for diffusing the knowledge of

finger, a piece of intestinal mucous membrane, and a child's hand—whose mode of preservation so exactly corresponded with that in Ruysch's Thesaurus Anatomicus that they are most likely the work of this master-hand. and were probably among those collected by Du Toy, Professor of Anatomy at Prague in the first half of the last century, in his scientific tour in the Netherlands. Even in the Vienna Museum, according to Schwediauer, towards the end of the last century some of Ruysch's preparations were to be found. Those at Prague I have examined, and found them entirely worthless." On page 595 he speaks of them as "scarcely to be recognized as injections of the vessels," and of the "ruined specimens in Greifswald and Prague . . . which through long continuance in spirit (liquor balsamicus) are brittle, and by the development of the fatty acids are discolored and reduced to a grayish-brown and crumbling pasty mass (Teig)—extravasation everywhere."

The Russian collection, however, Hyrtl seems not to have examined, and it is with pleasure, therefore, that I can state both on the authority of a letter from E. Schuyler, Esq., of the United States Legation at St. Petersburg (see the letter in the Phila. Med. Times, Feb. 1, 1872, p. 173), and another private letter from Prof. Pelechin, Assistant Professor of Surgery in the Imperial Medical School of St. Petersburg, that Ruysch's cabinet forms at the present time part of the Anatomical Museum of the Imperial Academy of Sciences, and is in an excellent state of preservation, the injections being perfect. Unfortunately, a small piece of a fetal intestine sent me by Prof. Pelechin for microscopical sections was destroyed by the carelessness of a third person. It was perfectly preserved, and looked very like a successful vascular injection.

* Restricted as I was in time, I was unable to develop many points as I would gladly have done had time allowed. The principal cultivators of the art of injections since Ruysch are as follows: Alex. Monro primus added the stopcock to the injecting tubes, and used double injections, viz.: glue to fill the finer vessels, followed by wax for the coarser. None of his preparations remain even in Edinburgh. Hyrtl, Zerglied., p. 599.

Lieberkühn (Berlin, 1711–46) was the first whose injections really stood the test of the microscope, and are worthy of comparison with the preparations made at present. Sixty-six of them are in the Vienna Museum, each in the focus of one of his simple microscopes which are attached to the slides. He first made the joint between the syringe and the arterial anatomy among the profession, and for anatomical and microscopical research, they are vastly better. Injections of plaster of Paris,* wax, paint, glue,† ether, and rubber everyone can now make, and the wonderfully beautiful results of Hyrtl, Gerlach, Beale, and Thiersch are only equalled by the ingenuity of Chrzonszczewsky, who has recently effected the physiological injection of the bile-ducts by coloring the bile and then tying the hepatic duct. Bidloo, in Amsterdam, in 1685, and Cowper and Nicholls, of Oxford,‡ a little later, added to our means of illustration by injecting the vessels and hol-

tube air-tight by means of friction instead of a screw. The wings by which it is now held were as yet unknown, and were replaced by a hook. He used wax, resin, turpentine, and cinnabar. Hyrtl, op. cit., p. 602.

In the present century, Shaw's "cold paint injection" (see Parson's Anat. Preps., pp. 2, 3, and Horner's Pract. Anat., Introd., pp. xviii and xix, where this is attributed to Allan Ramsay) has been largely used. Bowman's double cold injection by acetate of lead followed by chromate of potash, both in solution, Voigt's solution of glue, Gerlach's of carmine, Beale's of Prussian blue, etc., have all been admirable. No one has done more to advance the art than Hyrtl himself, who was the first to make preparations of two, three, and four different colored injections, and has left no kingdom, family, or genus whose anatomy is not illustrated by his splendid researches. No medical man should visit Philadelphia without inspecting the splendid collection of his injected, and especially his corroded, preparations, recently purchased (1874) by the College of Physicians for the Mütter Museum. They are the most superb specimens of anatomical preparations I have ever seen.

* First used by Trew (Commerc. Liter. Noricum, 1732, p. 298), and now in use generally in this country and in Berlin, while wax in various forms and combinations is used in Edinburgh, London, Heidelberg, Paris, Vienna, etc.

† First used by P. S. Rouhault, Surgeon to the King of Sardinia, 1718; Hyrtl, Zerglied., pp. 589, 590.

‡ Wm. Hunter (Introd. Lect., p. 56), and following him most other English and American writers (e. g., The Gold-headed Cane, p. 129; Horner's Anat., Introd., pp. xiv-xv, note), give the sole credit of this beautiful invention to Professor Nicholls. Hyrtl, however, places the credit further back and of right with Bidloo (Anat. Corp. Human., Amstel., 1685), who injected melted bismuth into the lungs, and Cowper (The Anat. of Human Bodies, Oxford, 1697), who used lead (Hyrtl, Zerglied., p. 604). Possibly Nicholls was the first thus to prepare the *vessels*.

low viscera with wax or metal, and then corroding or macerating the animal textures, leaving the injection as their perfect representative. Auzoux's splendid models have won for him the cross of the Legion of Honor.* Suchet, about 1850, revived the Egyptian method of tanning, but, unfortunately and wrongfully, kept the process a profound secret. In 1867, at the Paris Exposition, in noble contrast to this illiberal spirit, Brunetti, of Padua, explained to the Paris Medical Congress, in the crowded amphitheatre of the École de Médecine, his method of tanning by which he had made the astonishing preparations which he then exhibited. For durability, preservation of form and structure, both anatomical and pathological, even to microscopical exactness, they are unrivalled, and he was rewarded with a special gold medal, as well deserved as was the applause his liberal spirit elicited from an appreciative audience.†

Still later (1873), Dr. Marini, of Naples, exhibited at the Vienna Exposition some anatomical preparations made by some new methods (which he also wrongfully keeps secret), which, it is asserted after ten years, retain all their original freshness and natural appearance even to the fatty tissues.

* Plastic models are now made by Auzoux with great beauty and exactness, and the history of their development may be found in the New Amer Cyc., first ed., vol. i, pp. 517, 518, and vol. ii, p. 409. In 1823 in the reorganization of the universities to get rid of the materialism of the French Revolution the old prejudices against dissection were revived. In consequence of the difficulties thus thrown in the way of dissection, it occurred to Auzoux, in 1825, to make models in papier-maché. In 1830 the invention was perfected, and Auzoux now employs from sixty to eighty hands in his manufactory, and supplies the world with his models (of which he makes about two hundred), in human, comparative, and vegetable anatomy.

† See Med. News and Library, Jan., 1868. I have in my possession now two specimens of tuberculosis of the lungs and cirrhosis of the liver, kindly sent me by Professor Brunetti, which are witnesses to the excellence of his method. The color is, of course, destroyed by the alcohol and the tanning.

The body of Thalberg has been thus preserved for the adornment of his widow's drawing-room.*

Dissections having for their object such permanent preparations cannot be made in haste. They require considerable time. So too dissections for a series of lectures on various systems, such as the muscular, the vascular, etc., require that we shall be able to preserve the body unless we go back to the short courses of bygone days. Thus, in Edinburgh, in 1697, in the first course of public lectures, as the felon's body by law had to be buried in ten days, ten lectures were delivered on successive days by as many different lecturers, in which the entire subject was treated. How hurried the course was we may judge, seeing that on one day the brain, spinal cord, and all the nerves were finished, and on another, all of the five senses.† But when we go back to Mondini in 1315, we find him the embodiment of brevity, for he completed the anatomy, physiology, and surgery of the entire body in five lectures.

The first example we have of the use of preservative means is in the now familiar Egyptian mummies. Believing in the immortality of the soul, and that they could retain the soul within the body so long as its form was preserved entire, it was very natural that the Egyptians should endeavor to do by art what nature showed them to be possible in the desiccated mummies of the deserts around them. Various methods

* Med. News and Library, Nov., 1873, p. 183; Med. Times and Gaz., Sept. 6, 1873.

† Edin. Med. Journal, Oct., 1866, p. 294. The meagre number of lectures on important branches in later times also is striking. Thus, Mr. Bronfield, of St. George's Hospital, delivered but thirty-six lectures on anatomy and surgery, Dr. Nicholls, William Hunter's teacher, lectured on anatomy, physiology, pathology, and midwifery in thirty-nine, and Mr. Nource, at St. Bartholomew's, embraced "totam rem anatomicam" in twenty-three lectures. (John Hunter's Life, p. 4, note.) William Hunter enlarged the number of lectures on anatomy alone to eighty-six, about the present length of such a course.

were adopted, of which we have a short description in the embalming of Jacob's body in Genesis,* and at a greater length in Herodotus and Diodorus Siculus. Three principal modes existed, differing chiefly in expense. The cheapest was available to even the poor, the second cost about $450, and the third about $1250.† In the last, having removed the brain and its membranes through the nostrils, by breaking through the ethmoid bone with a curved piece of iron, they made an incision of five inches in the loins, removed the thoracic and abdominal viscera, cleansed them with palm wine and aromatics, and, after a prayer by the priest that all the sins of eating and of drinking might be forgiven, cast them into the river.‡ The abdomen was next filled with every sort of spicery except frankincense, and the body placed for forty days in natrum, an impure carbonate of soda. The heart embalmed apart, having been placed between the thighs, the whole body was then wrapped in cere-cloths with all the exactness of our modern spiral and reverse bandages, and sealed up with wax or bitumen,§ and in some cases even gold was used.‖ Bitumen in many instances was used in the body itself. In case the usual means were wanting, honey was used as the sole preservative, as in the case of Alexander the Great.¶ Some seem to have been preserved by tanning, and then enveloped in wax. In fact, the very name of mummy**

* Gen. l: 2, 3.

† Rawlinson's Herod., vol. ii, pp. 119, 120, and notes.

‡ Pettigrew's Hist. of Egyptian Mummies, London, 1834, p. 58.

§ Rawlinson's Herodotus Hist., ii, § 136, and Diodorus Siculus, Bk. I, vol. i, p. 102, § xcii.

‖ One was found in Siberia, wrapped in forty pounds of gold. Pettigrew, op. cit., p. 65.

¶ Statius, lib. iii, Carm. ii, v. 117. Pettigrew, op. cit., p. 86. King Aristobulus's body was similarly preserved. Josephus, Antiq., lib. xiv, cap. vii.

** Rawlinson's Herod., vol. ii, p. 122, note.

is supposed to be derived from the Arabic "mummia," from "mum," "wax."*

The mummies have been put to some curious uses. The Egyptians gave them as pledges for the repayment of bor-

* William Hunter, at the close of each session, usually devoted one lecture to teaching his students how to make preparations, and described also a process in imitation of the Eygptian method, which he had put in use. In the case of the wife of Martin Van Butchell (whose body is now in the Museum of the Royal College of Surgeons) his success was very good, and her husband's own account of it is such a curious document that I give it below. Not satisfied with preserving this treasure, he soon solaced himself with a second wife:

"14 Jan., 1775. At 2½ this morning my wife died. At 8 this morning the statuary took off her face in plaster. At half-past 2 this afternoon Mr. Cruikshank injected at the crural arteries, 5 pints of oil of turpentine mixed with Venice turpentine and vermilion.

"15th. At 9 this morning Dr. Hunter and Mr. C. began to open and embalm the body of my wife. Her diseases were a large empyema in the left lung (which would not receive any air) accompanied with pleurisy and pneumonia and much adhesion; the right lung was beginning also to decay, and had some pus in it. The spleen hard and much contracted; the liver diseased called Rata Malpighi. The stomach very sound. The kidneys, uterus, bladder, and intestines in good order. Injected at the large arteries, oil of turpentine mixed with camphored spirits, i. e. 10 oz. camphor to a quart spirits, so as to make the whole vascular system turgid; put into the belly part 6 lbs. rosin powder, 3 lbs. camphor powder, and 3 lbs. of nitre powder mixed with rectified spirits.

"17th. I opened the abdomen and put in the remainder of powders and added 4 lbs. rosin, 3 lbs. nitre, and 1 lb. camphor. . . .

"18th. Dr. H. and Mr. C. came at 9 this morning and put my wife into the box, on and in 130 lbs. wt. of Paris plaster, at 18 pence a bag. I put between the thighs, 3 arquebusade bottles, one full of camphored spirits very rich of the gum, one containing 8 oz. of oil of rosemary, and in the other 2 oz. lavender.

"19th. I closed up the joints of the box lid and glasses with Paris plaster mixed with gum water and spirits of wine.

"25th. Dr. H. came with Sir Thomas Wynn and lady.

"Feb. 5. Dr. H. came with 2 ladies at 10 this evening.

"7th. Dr. H. came with Sir Jno. Pringle, Dr. Herberden, Dr. Watson, and about 12 more Fellows of the Royal Society.

"11th. Dr. H. came with Dr. Solander, Dr. ——, Mr. Banks, and rowed money,* the "hypothecated bonds" of the Alexandrian "Bourse." But in the middle ages they were still more curiously employed, as potent remedies in falls, bruises, and other external injuries. "Mummy," says Sir Francis Bacon, "hath great force in staunching of blood, which may be ascribed to the mixture of balms that are glutinous." Francis I always carried with him a little packet of powdered mummy and rhubarb for falls and other accidents.† So great was the demand that as the real article was difficult to obtain, like Waterloo bullets, they were manufactured at enormous profits by avaricious Jews in Alexandria. Ambroise Paré, who was born in 1509, in his book on the mummy,‡ states that having learned this fact from his friend De la Fontaine, who had observed it in Egypt, and also having never seen any good effect from the remedy, he did all in his power to discourage its use both in his own practice and also in all his consultations. He gives us too, in his book on embalming, a method he himself used for the preservation of a body, with very gratifying success, and as it is the earliest of the

another gentleman. I unlocked the glasses to clean the face with spirits of wine and oil of lavender.

"12th. Dr. H. came to look at the neck and shoulders.

"13th. I put 4 oz. camphored spirits into the box at the sides and neck, and 6 lbs. of plaster.

"16th. I put 4 oz. oil of lavender, 4 oz. oil of rosemary, and ½ oz. oil of chamomile flowers (the last cost 4 shillings) on sides of the face, and 3 oz. of very dry powder of chamomile flowers, on the breast, neck, and shoulders."

The body resembles a Guanche mummy rather than an Egyptian, and is, properly speaking, a desiccated rather than an embalmed body. Pettigrew, op. cit., p. 258, note.

* Pettigrew, op. cit., pp. 16 and 17.

† Pettigrew, op. cit., p. 9. Even to-day they are used by the Arabs mixed with honey (p. 12).

‡ The Workes of that Famous Chirurgion, Ambroise Paré, London, 1649, p. 332. Note the capital pun on his name in the motto under his portrait in the frontispiece. "Humanam Ambrosii vere hæc pictura Paræi, effigiem, sed opus continet ambrosiam."

Portrait of Ambroise Paré.

more modern methods, I will give its quaint and curious details and results.*

"The body which is to be embalmed for a long continuance must first of all be emboweled, keeping the heart apart that it bee embalmed as the kinsfolkes may thinke fit. Also the braine, the scull being divided with a saw, shall be taken out. Then shall you make deepe incisions alongst the armes, thighes, legges, backe, loynes, and buttockes, especially where the greater veines and arteries runne, first, that by these meanes the blood may be pressed forth, which otherwise would putrifie, . . . and then that there may be space to put in the aromaticke powders. The whole body shall be washed over with a sponge dipped in aqua vitæ and strong vinegar, wherein shall be boiled wormewood, aloes, coloquintida, common salt and alum. Then these incisions and all the passages and open places of the body and the three bellys shall be stuffed with the following spices grossely powdered: ℞.—Pulv. rosar., chamomil. melil. balsam, menthæ, aneth. saluiæ, lauend. rosism. maioram. thymi, absinthii, cyperi, calami aromatici, gentianæ, ireos flor. assæ odoratæ, caryophyll. nucis moschatæ, cinnamomi, styracis, calamitæ, benioini, myrrhæ, aloes, santal. [with exquisite indefiniteness], quod sufficit. Let the incisions be sowed up, and forthwith let the whole body be anointed with turpentine dissolved with oyle of roses and chamomile. Then wrap it in linen cloath and ceare cloaths. I put in mind hereby, that so the embalming may become more durable, to steepe the bodys in a woodden tubbe filled with strong vinegar and the decoction of aromaticke bitter things, as aloes, rue, coloquintida and wormwoode, and there keep them for twenty days, pouring in thereunto eleven or twelve pints of aqua vitæ." Alcohol is the real means, you will observe. And now for the result. "I have at home the body of one that was hanged, which I begged of the sheriff, embalmed after this manner,

* Op. cit., pp. 1130, 1132.

which remains sound for more than twenty-five yeeres, so that you may tell all the muscles of the right side (which I have cut up even to their heads, and plucked them from those that are next them for distinction's sake, that so I may view them with my eyes and handle them with my hands, that by renuing my memory I may worke more certainely and surely when as I have any more curious operations to be performed). The left side remains whole, and the lungs, heart, diaphragma, stomache, spleene, kidneyes, beard, haires, yea, and the nailes, which being pared [he adds with charming naïveté], I have often observed to grow again to their former bignesse."

A century later than Paré, Ruysch, as we have seen, was said to have the most astonishing means for the preservation of his subjects. But we must make large allowances for the natural exaggeration of the extremely happy results of what was then a new art. Nor should we be the better off did we possess the secret of his contemporary De Bilsius, a noted charlatan of Rotterdam, whose boasted method, Haller says, was bought by the States of Brabant for the enormous sum of 122,000 florins, or more than four times the price of Ruysch's first museum. The bodies he pretended to embalm for the University of Louvain were soon destroyed, and, apparently in proof of the inefficacy of his own method, so foul was the air of the rooms in which he prepared his subjects, that it was said to have been the cause of the consumption to which he fell a victim.*

The traveller in Europe to-day finds a number of specimens of bodies preserved either by art or by nature, curious alike to the antiquary and the anatomist. In Milan is the body of St. Carlo Borromeo, who died in 1584; on the Rhine, near Bonn, in an old monastery, lie over a score of monks in cassock and cowl, placed in its vault before Columbus had discovered the New World; and again, in the church of St.

* Bayle et Thillaye, op. cit., vol. ii, pp. 84, 85.

Thomas, at Strasburg, are seen the bodies of the Count of Nassau and his daughter over six hundred years old. The skin is yellow and shrivelled, but perfectly preserved; the small clothes of the father have been replaced by imitations, but the clothes of the daughter are intact. The lace on her blue gown is perfect, bunches of silver flowers adorn her hair, jewels lie on her breast, and even diamond rings clasp the shrivelled fingers as in mockery of death. All of these have been probably preserved by the aluminous soils in which they were placed. Cold has done the same work for the ghastly remains in the morgue on top of the great St. Bernard, while desiccation has shrivelled both features and limbs into contortions worthy of purgatory.

The largest collection of bodies preserved, not by nature, but by art, and by the simplest method, namely, that of desiccation by means of artificial heat, is in the monastery of the Capuchins, near Palermo. All its inmates who have died for the last two hundred and fifty years, more than two thousand in number, stand upright in ghostly companionship in the niches of its subterranean galleries.*

None of these means, however, would do for dissection. For practical anatomy the introduction of alcohol† without the numerous drugs that Paré used, was the first efficient means which rendered patient and prolonged dissection available, and Cuvier points to its use as an indispensable step in the progress of comparative anatomy, as it rendered possible

* The reader who is curious in such things will find many other such instances described in full in Pettigrew's Hist. Egypt. Mummies, and in Harlan's Gannal's Hist. of Embalming, 8vo, Philada., 1840. Among them are not only full accounts of the Egyptian mummies, but also of those of Peru, Mexico, the Guanches, etc., and of the bodies preserved at Bordeaux, Toulouse, etc. Dr. A. B. Granville's Essay on Egyptian Mummies, Phil. Trans., 1825, pp. 969 et seqq., also contains some interesting facts, including a case of ovarian disease discovered in a mummy.

† Abucasis in the twelfth century first showed how to get spirits from wine. Raymond Lully (thirteenth century) first dehydrated it by carb. potass. Gmelin's Handb. Chem., vol. viii, p. 194.

the preservation of animals while being transported from distant parts of the world. Since then chemistry has added largely to our means for such purposes, such as chloride of zinc, arsenic, salt and nitre, hyposulphite of soda, acetate of aluminum, and other means for special purposes. In Berlin, Heidelberg, Vienna, etc., alcohol is used where a prolonged dissection is necessary; but for the ordinary dissections of students nothing whatever is used. The greater number of unclaimed bodies, arising from overcrowding, poverty, and want, so amply supplies the anatomical schools that they dissect without any antiseptic, and remove the subjects the moment decomposition sets in. In Vienna no part is allowed to remain on the tables more than seven days. But while such an arrangement would be disastrous here, it works well there by reason of their different mode of study. The dissecting-rooms are only open from twelve noon to seven P.M., and from October to April; and during the first two years the student does little beyond dissection and the study of anatomy.

In this country, where the supply of material never equals the demand, especially in the winter, we are compelled to preserve them for months. The chloride of zinc and arsenic are the favorite means.*

By such a hasty review as I have now given of the imperfect methods, the meagre advantages, and the restricted opportunities for the cultivation of practical anatomy by former students of medicine, we can appreciate how vastly better

* For some researches of my own with a new preservative—hydrate of chloral—see the Philadelphia Medical Times, March 21, 1874, On the Anatomical, Pathological, and Surgical Uses of Chloral. My subsequent experiments have fully borne out the conclusions there stated. They will be given at length in a subsequent paper (Amer. Jour. Med. Sci., July, 1875).

In the N. Y. Med. Record, Jan. 9, 1897, p. 48, I have shown that hyaline and granular casts and epithelial cells were preserved in the urine by chloral for nearly twenty years.—(W. W. K., 1905.)

off we of to-day are from every point of view. The good old times are the myths of croakers with which they would repress the progressive spirit of the present. Never has anatomy made so rapid and so substantial progress as in the present century, and never has it in this country attained such a point as it occupies to-day. Yet we lack much. Our very wealth of opportunities threatens us with a Capuan repose, unless the stirring examples of the great men who have preceded us stimulate us to exertion. Tertullian says that Herophilus, in Alexandria, dissected over six hundred bodies.* Berengarius of Carpi, the contemporary of Vesalius, dissected over one hundred.† Haller, who died a century ago, says that with his own hand he had dissected over four hundred in seventeen years‡; and that almost unequalled worker, John Hunter, when asked at the trial of Captain Donellan, in 1781, whether he had not dissected more than any other man in Europe, replied, "In the last thirty-three years I have dissected some *thousands* of bodies."§ It seems an exaggeration; but remember his habits. For thirty years his working-day consisted of nineteen to twenty hours. He rose at four or five o'clock, and always dissected till his breakfast hour, at nine, and after his labors in practice and the hospital-wards were over, his labors in the dissecting-room recommenced, and he never left it till midnight or even later. When any of you, then, visit the Hunterian Museum, in London, remember what it cost him in money, and, what is more, the unceasing labor of a long life. Such diligence has sometimes, alas! cost the world more than money or toil. It cost the life of Bichat, who died at barely thirty-one from constant confinement in his dissecting-rooms. "Bichat," wrote Corvisart to the First Consul, "has just died on a field of

* Encyc. Brit., vol. ii, p. 751. Wm. Hunter, Introd. Lect. p. 19.

† Bayle et Thillaye, op. cit., vol. i, p. 244.

‡ Encyc. Brit. 8th ed., vol. ii, p. 715.

§ Life, vol. i, p. 134.

battle that counts more than one victim. No man in so short a time has done so much and so well."*

Joining diligent work to the unequalled opportunities that we now have, the laborers in the vast field of medicine, in whatever department they toil, will meet with a reward never before equalled. The future opens to the active worker the brightest prospects. Happy will he be who knows how to avail himself of its advantages!

* Bichat, Sur la Vie et la Mort, p. xiv.

THE PHILADELPHIA SCHOOL OF ANATOMY (1820-1875).

The middle building is the original one; the lower one to the right was added to the School later. That to the left was a carpenter shop.

THE HISTORY OF THE PHILADELPHIA SCHOOL OF ANATOMY AND ITS RELATIONS TO MEDICAL TEACHING.*

MEN and institutions alike are to be judged by two standards: first, by the work they do themselves, and, secondly, by the work they train others to do, and thus prolong indefinitely their influence. Some are great in the one,—solitary students, whose organizing ability and personal influence whether by mental or by actual contact is but little developed. Others live and die, leaving but little, it is true, that men may quote or name, but leaving a precious harvest of remoter influences on even a distant mental posterity. Some few are great in both. Great teachers are apt rather to excel in their personal magnetic influence on others, and the world owes more than it will ever know to their continuing, but untraced, influences.

Tested by either of these rules, the "Philadelphia School of Anatomy" has accomplished a not ignoble work. Within its walls, earnest, intelligent, laborious men of science have taught, experimented, and investigated, and published the results of their work in many a book and pamphlet and scientific paper, thus fulfilling the first test; while to judge it by the second, it is only necessary to point to the thousands of men who have studied and dissected here, and here begun their scientific lives, and are now spread all over the country, and in fact all over the world, doing the best of work as practitioners, teachers, writers, and original investigators.

* A lecture delivered, March 1, 1875, at the dissolution of the school. Reprinted with the kind permission of J. B. Lippincott Company.

Few schools of this sort have existed. Many, very many, dissecting-rooms and private anatomical schools have been established by individuals, to continue so long as they themselves chose to teach, and then to disappear; but this one has not been the creature of any one man. It has outlived not only its founder, but most of its earlier teachers. It has never been a chartered institution, or enjoyed the "jura, honores, et privilegia ad eum gradum pertinentia," but it has outlasted more than one such in this city alone. In this country I know of no similar school, and the only one in Britain which outstripped it either in age, in celebrity, or in influence was the Great Windmill Street School. Founded in 1770* by William Hunter, it boasted the names of both the Hunters, of Hewson, Cruikshank, Baillie, Wilson, Brodie, Sir Charles Bell, Shaw, Mayo, and Cæsar Hawkins, and came to an end in 1833, having existed for sixty-three years, a period only exceeding the life of this school by eight years.

The PHILADELPHIA SCHOOL OF ANATOMY was opened in the month of March, 1820 (nine years before the lately destroyed Medical Hall of the University of Pennsylvania was built), as the private anatomical school of *Dr. Jason Valentine O'Brien Lawrance,* under the name of the "Philadelphia Anatomical Rooms." It began at the upper end of Chant Street (then called College Avenue), on the north side, in the easternmost of the two buildings since used by the school. About this date, besides the anatomical rooms of the University, there were several private dissecting-rooms in this city, but they were on a different basis from this. In 1818 Dr. Joseph Parrish opened one almost in the rear of Christ Church and placed Dr. Richard Harlan in charge of it. In 1822 Dr. Thomas T. Hewson opened another over his stable in Library Street, next to the present Custom House, and afterwards, in 1829, in Blackberry Alley, in the rear of his house on Walnut Street above Ninth. Dr. George McClellan had another

* See p. 11.

on Sansom Street above Sixth, and a fourth existed on the west side of Eighth Street above Jayne (then Lodge Alley), but under whose care I have not been able to discover. But, so far as I can learn, all of these were, mainly at least, for the office students of their proprietors, and they were all ephemeral. Lawrance, however, who was a great favorite with the students, at their request opened his school for all who might come, and so founded a school which has existed for fifty-five years, and has educated thousands of students and scores of teachers for their work.

Lawrance was born in New Orleans in 1791, and graduated at the University of Pennsylvania in 1815, after six years of study, at the age of twenty-four. He returned at once to his native city, and began the practice of medicine with his stepfather, Dr. Flood. But he thirsted for the scientific advantages he had found in this city during his student-life, and at the end of three years he sacrificed all his unusually brilliant prospects at home, and came to Philadelphia in 1818, when he at once renewed his scientific labors. At that time the University (then our only medical school) closed its doors in April, and they remained unopened till November, for our present admirable summer courses were begun only about ten years ago. To fill out this long hiatus Lawrance opened his school and gave a course on Anatomy and Surgery, which began in March, had a recess in August, and ended in November. He gave six lectures in the week, and his personal qualities, as well as the ease and perspicuity of his style as a lecturer, made his school a decided success. In the fall of the same year he became the assistant to Dr. Gibson, the Professor of Surgery in the University, and in 1822 he was also made the assistant to Dr. Horner, then Adjunct Professor of Anatomy. These positions, together with that of Surgeon to the Philadelphia Hospital, would have assured him in time a remunerative practice, but, like many another who has lived "the scientific life," he had to struggle on with but a scanty income in the earlier days of his practice, and he died, before the reward had come, a victim to his zeal and devotion. While attending the poor in the Ridge Road District, during an epidemic of typhus fever, in the summer of 1823, he, who had lived among cadavera unharmed, was attacked by the disease, and died in August after a short illness.*

Like most of his followers in the school, not satisfied with teaching, he was also a frequent writer, as well as active in original investigations and experiments. In 1821 the "Academy of Medicine" was formed "for the improvement of the science of medicine," and he entered into its work with alacrity. The discovery of the absorbent vessels had led to the belief that they were the only channels of absorption until Magendie had then recently reasserted absorption by other channels, especially the veins. Dr. Chapman, then Professor of Practice and Physiology in the University, utterly rejected these views, and at his instance, and with his generous pecuniary assistance in the summer of 1822, Dr. Lawrance, assisted by Drs. Harlan and Coates, a committee of the Academy of Medicine, performed upwards of ninety experiments on living animals. Not satisfied with these, in the succeeding summer, with Dr. Coates, he repeated and varied them in a second series of over one hundred experiments, and he had begun also a third series to determine absorption by the brain, which was only cut short by his untimely death. The results were published in Dr. Chapman's journal, "The Philadelphia Journal of the Medical and Physical Sciences" (iii, 273, and v, 108 and 327), and they not only verified, but extended, Magendie's views.

In New Orleans he had recklessly exposed himself to yellow fever in making necropsies on putrid bodies. He investigated the subject still further in the epidemic of 1820, and left the most complete record of autopsies in this disease then extant.

* Obituary Notice, by Dr. Coates, Phila. Jour. Med. and Phys. Sci., 1823, p. 171, and Eulogium by Professor Jackson, ibid., p. 376.

So diligent a writer was he that he left behind him over three thousand pages of manuscript, much of it for use in a projected work on Pathological Anatomy, a subject then strangely neglected in America.

At Dr. Lawrance's death the school passed into the hands of *Dr. John D. Godman.* He was born in 1794* in Annapolis. He began life as a printer, but at the age of fifteen he studied medicine with Dr. Davidge, Professor of Anatomy in the University of Maryland. While still a student he lectured for his preceptor for some weeks with such enthusiasm and eloquence as to gain universal applause. Soon after his graduation, in 1821, he was appointed Professor of Anatomy in the Medical College of Ohio, a recently-established institution, in which he stayed only a year. Returning to Philadelphia, he retired from practice in 1823, when he began teaching in the anatomical school. The very first winter he had a class of seventy students. As was the custom for many years afterwards, he gave three courses a year, viz.: the autumn course, twice a week from September to November; the winter, four times a week from November to March; and the spring, twice a day (with a view to graduation) from March 1 to April 1, the remainder of the year being a vacation in teaching, but devoted to work. The fee for each course was ten dollars, the same as at present, though but two annual courses are now delivered, from October till March and April till October, with a recess in July and August.

Dr. Godman's style as a lecturer was characterized by simplicity of language, directness of statement, and fertility of illustration. His lecture-table was peculiar in its construction, being arranged with ratchets and screws so that the whole subject, or any part of it, could be lifted or lowered at will. Another peculiarity, also, in which he prided himself, was his invariable habit of dissecting before the class while he lectured, no previous dissection, however incom-

* Dr. Sewall states 1798; Dr. S. Austin Allibone, 1794.

plete, having been made,—a method which was only practicable to such an expert dissector as he, and before the introduction of the chloride of zinc which hardens the tissues so much, but which would again be possible if chloral be used. Dissecting wounds were then frequent. During his first winter several of his class suffered; his janitor, from a scratch on his thumb nearly lost his life, and Dr. Godman himself was poisoned three times, once so severely that his arm was useless for some weeks. All the means then in use, salt and saltpetre, corrosive sublimate, pyroligneous acid, etc., were poor preservatives, for he speaks of repeatedly "dissecting bodies in various states of putrefaction," and he made the great improvement of using whisky—an impure form of alcohol—for injection. Since that time chloride of zinc (which was introduced in this city in 1846 by Prof. Ellerslie Wallace, then Demonstrator of Anatomy in the Jefferson Medical College), alcohol, and more lately chloral (which I was the first to use eighteen months ago*), have banished dissecting wounds proper, and in an experience as student and teacher of fifteen years, in intimate acquaintance with several thousand students, I have never known a single instance of such a wound.

About 1824 he established, in connection with the school, a reading-room and library, supplied with text-books and journals, and not long afterwards he desired to enlarge the sphere of the school by additional associated lecturers. Accordingly he invited Dr. R. E. Griffiths (afterwards of the University of Virginia) to lecture on Practice and Materia Medica, and Dr. Isaac Hays on Surgery and the Eye, he himself lecturing on Anatomy and Surgery,—a scheme which was, however, frustrated by his removal. Dr. Hays was appointed to deliver the "Introductory," an unfinished production still lying in the drawer of the accomplished editor of "The American Journal of the Medical Sciences." In 1826 his widely-spread fame had attracted attention to him so prom-

* See my paper in the Philadelphia Medical Times, March 21, 1874.

inently that he was called from College Avenue to the chair of Anatomy in Rutgers Medical College, recently established in New York City. It was no slight compliment that he should be thus selected as a member of the faculty in a school which had to struggle for existence in the midst of bitter rivalries with far older institutions. Unfortunately, his health broke down in the midst of his second course, and, after vainly traveling in search of health, he settled in Germantown, where he died in 1830, in the serene hope of a blissful immortality. The closing scenes in his life were so remarkable for Christian faith that his Memoir, by Professor Sewall, has been published by the American Tract Society, and is also appended to Newman Hall's narrative of the death of Dr. William Gordon.

Dr. Godman's early education had been very defective; but by his industry he mastered Latin, Greek, French, German, Danish, Italian, and Spanish, and, as Robert Walsh remarks, "he finally became one of the most accomplished general scholars and linguists, acute and erudite naturalists, ready, pleasing, and instructive lecturers and writers of his country and era." He was ever ready with his pen, as well as his scalpel. In 1825 he became one of the editors of the "Philadelphia Journal of the Medical and Physical Sciences." In 1827, largely through his influence, the profession in New York agreed to support this journal if it dropped its local name, and from this sprang our representative quarterly, "The American Journal of the Medical Sciences." Among the extensive works he planned, while in College Avenue, none saw the light save the "Natural History of American Quadrupeds," in three volumes. His laborious and ardent pursuit of knowledge is well shown by the fact that in investigating the habits of the shrew mole he walked many hundred miles. He edited also the "Journal of Foreign Medical Science and Literature," and Sir Astley Cooper on "Dislocations and Fractures." He translated from the Latin, in 1824, Scarpa on the "Bones." He published two books, "Anatomical Investigations, comprehending Descriptions of the Various Fasciæ of the Human Body, the Discovery of the Manner in which the Pericardium is formed from the Superficial Fascia, the Capsular Ligament of the Shoulder-joint from the Brachial Fascia, and the Capsular Ligament of the Hip-joint from the Fascia Lata, etc." (Philadelphia, 1824), and "Contributions to Physiological and Pathological Anatomy" (Philadelphia, 1825), and papers on "The Propriety of Explaining the Actions of the Animal Economy by the Assistance of the Physical Sciences" (Philadelphia Journal, etc., iii, 46), "On the Doctrine of Sympathy as Based on Anatomy" (ibid., vi, 337), "On Arterial and Other Irregularities" (ibid., xii, 201) and other papers on the "Fasciæ" (ibid., vi, 261, and viii, 87). Before he published his alleged discoveries as to the fasciæ, he invited the anatomists and surgeons of the city to a demonstration by actual dissection before them.

When Dr. Godman went to Rutgers College, in 1826, he was succeeded by *Dr. James Webster*. He retained the school for four years, until, in 1830, he was called to the chair of Anatomy in the Geneva Medical College. Though not so polished and industrious as Godman, he was a good teacher and an excellent anatomist. He was thoroughly devoted to the interests of his class, and at one time, when there was greater difficulty than usual in getting subjects,—a chronic ailment of dissecting-rooms,—he sat up night after night, watching that neither the University nor any private room should obtain them till he was supplied, and he gained his point. His literary labors while here were limited to editing the "American Medical Recorder," from 1827 to 1829, when it also merged into the "American Journal of the Medical Sciences," and, I believe, also another rather pugilistic journal, which, however, was short lived.

This brings us down to living persons; and my account must now deal rather with narrative than criticism. After

Dr. Webster left, the rooms were vacant for a year,—the only hiatus in their history.

In 1831, three years after his graduation from the University, *Dr. Joseph Pancoast* reopened the rooms, and in the seven years he lectured here he laid the foundation for his subsequent brilliant career both as anatomist and surgeon. He gave the usual three annual courses which Godman had established. No other lectures were given in the building during his administration. In 1838 he was elected Professor of Anatomy in the Jefferson Medical College, in which position his fame has not been limited even by the wide bounds of the Republic. His pen also was not idle during these years. In his opening year he translated Lobstein on the "Sympathetic Nerve," from the Latin; later, he published Manec on the "Sympathetic" and on the "Cerebro-Spinal System in Man," edited "Quain's Anatomical Plates" in quarto, and fitly closed his career in the Avenue by preparing a new edition of Horner's "Anatomy," in two volumes.

On the promotion of Dr. Pancoast to the Jefferson, in 1838, *Dr. Justus Dunott* succeeded him, and lectured about three years, when *Dr. Joshua M. Allen* became his associate. Up to 1839 the Philadelphia Anatomical Rooms consisted solely of the east building, the other being a store-house. Now, the two buildings become sometimes rival schools, but for the most part united under one head. In 1838 *Dr. James McClintock* fitted up a dissecting-room at the southeast corner of Eighth and Walnut Streets, and called it the "Philadelphia School of Anatomy." In the spring of 1839, his next-door neighbor, the late Hon. William M. Meredith, vigorously remonstrated with him on account of the stench from his rooms, the cause being a lion's carcass, of which it could not be said, as of Samson's lion, "Out of the strong cometh forth sweetness." Dr. McClintock then rented and fitted up the western building, threw the second and third stories together as the lecture-room, in which we are now assembled, but very different from its present arrangement, which was made by Allen at a later date. The lecturer stood at the south, or Chant Street, end, and under the rising seats slept the janitor and his family; the first floor, afterwards the Museum, and now the dead-room, serving for parlor, dining-room, and kitchen. Moreover, at the Chant Street end, both in the second and third stories, was a small room, so that the lecture-room was much smaller than it is at present. Dr. McClintock gathered here a very large class by his brilliant demonstrations, until, in 1841, he was elected Professor of Anatomy in the Vermont Academy of Medicine (afterwards Castleton Medical College), and also in the Berkshire Medical Institution, Pittsfield, Massachusetts. Dunott and Allen (who had been McClintock's student and demonstrator) then occupied both buildings, under the name of the Philadelphia School of Anatomy. Soon after this (precisely when I have been unable to discover), Dr. Allen was left in sole charge, and from this date until 1852 he conducted a most successful school. While he was lacking in scholarship and cultivation, he insisted strenuously on neat dissection, and was clear and practical as a teacher, and many men still recall his instruction with great vividness and pleasure. While here he published his "Dissector's Manual."

One incident demands notice as an innovation up to that time unheard of. On a hot July day, about 1843 or 1844, one of our distinguished physiologists informs me, being himself then a student here, he entered the room adjoining the lecture-room, and was surprised to see in that place a bonnet and pair of gloves, and in a moment to hear the rustling of a lady's dress. Not that the presence of females was so rare in the school, but they scarcely needed so elaborate a toilet. Peering cautiously, as he then well might, into the lecture-room, he saw a lady at work at the table dissecting a negro subject. She afterwards dissected in the room above with the ordinary medical classes. "It was probably," says her sister, "the first time that a woman had dissected as a medical student." She had read with the late Prof. S. H. Dickson, of the Jefferson, then in Charleston, South Carolina, was residing in the family of Dr. William Elder, afterwards studied and graduated in medicine at Geneva, and is now practising her profession successfully in the city of New York. Two ladies have dissected here (privately, however) under my own supervision, one, Frau Hirschfeldt, who is now practising dentistry with great success in Berlin; the other, a young lady who desired to perfect herself as an anatomical artist, and who made many of my drawings. In the last two winter sessions, also, very many ladies were members of my classes in Artistic Anatomy, and were greatly interested in the dissection of the muscles.

In 1842 *Dr. William R. Grant,* who had been demonstrator of Anatomy at the Jefferson, held the western building for a year, when, on his becoming Professor of Anatomy and Physiology in the Pennsylvania College, he relinquished it to Dr. McClintock, and from 1843 to 1847 the two buildings were again under separate control, the eastern being occupied by Allen, the western by McClintock. In 1844 Dr. McClintock enlarged the school, having lectures on Practice by Dr. James X. McCloskey, and on Materia Medica by Dr. Jackson Van Stavern. With more mature plans, in the spring of 1847 he secured the charter of the Philadelphia Medical College, and during that summer their lectures were given partly in this building, partly in the School of Pharmacy, then in Filbert Street above Seventh. Its Faculty consisted of Dr. McClintock, on Anatomy, Physiology, and Surgery; Jesse R. Burden, on Materia Medica; Thomas D. Mitchell, afterwards of the Jefferson, on Practice and Obstetrics; and William H. Allen, now [1875] President of Girard College, on Chemistry. In the fall of 1847 the Philadelphia College removed to Fifth Street below Walnut, and both the buildings again came under Dr. Allen's control until 1852, when he was elected Professor of Anatomy in the Pennsylvania Medical College.

A name familiar to all present then follows—*Dr. D. Hayes Agnew.* He assumed the responsibilities of the school in 1852, and held it for ten years. During this period, beginning with but nine students, such was the prosperity of the school that he threw the small room in the third story into the lecture-room, to accommodate the crowds of students who gathered almost nightly to hear his lucid demonstrations. I well remember many a dyspeptic supper hastily swallowed that I might be early in attendance and so secure a good seat, and much of my own success is due to his example and training. Dr. Agnew also altered the second story of the eastern building for his Operative Surgery courses, in which his classes were large. While teaching here he published his "Dissector's Manual," his lecture on the career of Baron Larrey, a valuable and prolonged series of papers in the "Medical and Surgical Reporter," on "Anatomy in its Relations to Medicine and Surgery," and prepared a work on the fasciæ of the human body, which, however, he never published.

Although not a part of the proper history of the Philadelphia School of Anatomy, yet, as connected with the teaching done in the Avenue, it gives me pleasure to allude to the successful school established on the opposite side of the street by Dr. William S. Forbes. In 1856, while Dr. Agnew was teaching, Dr. Forbes opened his school, which was designed largely to give facilities for dissection to the students of the dental colleges, in one of which he was Professor of Anatomy. He continued to teach for twelve years, a period longer than any other teacher in the Avenue.

In 1862 Dr. Agnew relinquished the anatomical department to *Dr. James E. Garretson,* who had been his Demonstrator for five years. Dr. Agnew retained the course in Operative Surgery for a year, when he became Demonstrator of Anatomy and afterwards Professor of Surgery in the University. He was succeeded in the department of Operative Surgery from 1864–67 by *Dr. J. M. Boisnot.* After two years of successful teaching of Anatomy Dr. Garretson withdrew, on his election to the chair of Surgery in the Philadelphia Dental College. During his connection with the school, though he published nothing, his pen was not idle, for he has since given us his large work on "Oral Surgery," and who does not know the genial and philosophic "John Darby"?

In the summer of 1865 *Dr. James P. Andrews*, now of Lancaster County, assumed the duties of lecturer, but his health failing, he was succeeded in the autumn by *Dr. R. S. Sutton.* After a year's teaching, Dr. Sutton removed to Pittsburg, and on October 22, 1866, I gave the first lecture of my life to a class of seven students, of whom two were "capita mortua." With the present lecture, after nine years of unceasing labor, my connection with the school, and the school itself, ceases, since the property will be occupied by the new post-office, and science will yield to at least one form of literature.*

It ill becomes one to speak of himself, but I may perhaps be permitted to state the following facts: I have lectured here longer than any of my predecessors, Allen and Agnew only excepted; I have given nine winter and five summer courses on Descriptive and Surgical Anatomy, three summer courses on Clinical or Surface Anatomy, two courses on Artistic Anatomy, and thirteen courses on Operative Surgery, besides private courses to numerous individual students and graduates. I have had nearly fifteen hundred students, of whom at least five are already professors in medical colleges, and one has opened the first dissecting-room ever established in Japan. They have come from the District of Columbia, and every State in the Union, except New Mexico and Nebraska, and from fourteen foreign countries, as follows: Canada, Nova Scotia, Prince Edward's Island, New Brunswick, Cuba, Porto Rico, Mexico, Costa Rica, Nicaragua, Denmark, Norway, Prussia, Switzerland, and England.

* The two buildings occupied the space now a passageway on the western side of the present post-office building.—(W. W. K., 1905.)

From 1866 to 1870 I occupied only the western building, Dr. Richardson having the lower story of the other for his Quiz Class, and Dr. H. Lenox Hodge, from 1868 to 1870, the upper story for his courses in Operative Surgery, but in order to accommodate my increasing classes I was obliged, in 1870, to obtain the use of both buildings, and later still further to enlarge the lecture-room by placing the gallery over my head, while many, even then, were unable to obtain seats. During this time, also, I have published a series of "Clinical Charts of the Human Body," a sketch of the "Early History of Practical Anatomy," and a pamphlet on the "Anatomical, Pathological, and Surgical Uses of Chloral" (which I deem my most important contribution to practical anatomy).* I have edited, also, Flower's "Diagrams of the Nerves," and Heath's "Practical Anatomy," and have published anatomical and surgical papers on "A New Diagnostic Sign of Fracture of the Fibula," on "The Anatomy of the Optic Chiasm" (with Dr. William Thomson), on "The Ossification of the Atlas Vertebra," on "A Case of Asymmetry of the Skull," on "A Malformation of the Brain," on "The Physiology of the Inferior Laryngeal Nerves and the Intercostal Muscles," as observed in a case of judicial hanging, and numerous other general medical articles, besides gathering the materials for several other papers and perhaps more extended publications.

But no history of this school would be complete did it not include a fitting notice of the teachers who have been associated with it. It has held a peculiar relation to medical teaching in this city, and a very large part of its usefulness has consisted in the fact that it has afforded a field in which any eager aspirant for medical honors might enter without

* At the close of the lecture a subject injected six weeks before with one-quarter of a pound of chloral in six pints of water was shown, and its advantages fully illustrated. [Other methods have long since replaced the use of chloral, but its value as a preservative of urine is well established.—W. W. K., 1905.]

much risk as a "free lance." Medical teaching on other subjects is rarely directly remunerative. The expenses of rooms properly cared for, and of the means of illustration, so far outstrip the income, especially at the outset, when the lecturer is unknown, that few can afford the pecuniary risk of failure, and those few scarcely ever care to try. But a successful anatomist, since his classes are large, can readily meet the expenses of such a school, and thus afford to furnish accommodations for private teachers for a moderate sum, often merely a nominal one. It has always been my own policy, therefore, to encourage all such private teaching by charging a sum barely sufficient to cover my expenses, feeling that thereby I gave generous aid to the cause of medical teaching and to the teacher himself, and yet indirectly benefitted myself by making the school by so much the more a medical centre. Moreover, if one began and succeeded, he made a reputation, and the rewards that are sure to follow faithful and successful teaching came in due time; while if he failed here, he was but little the loser whether in pocket or in fame. But if one tries his "'prentice hand" as an official "Lecturer" in one of our medical schools and fails publicly, it damages him almost beyond recovery. In this way the Philadelphia School of Anatomy has been a fertile foster-mother of youthful teachers, of whom many are now among the brightest ornaments of our profession.

It has always been the habit in the medical profession, as in the legal, for the student to enter the office of a preceptor, formerly as an "articled pupil," more recently as an "office student," and by the payment of an annual sum—for many years one hundred dollars—he obtained more or less instruction according to his preceptor's ability, zeal, and conscientiousness. The more distinguished men gathered many such pupils, and when the labor of personal instruction became too onerous, they associated others with them in the duties of office instruction. Gradually the habit of lecturing grew up among them, and thus arose the numerous associations for medical instruction by lectures and by a daily "Quiz," which have been so prominent and have done such good work in our Philadelphia medical teaching.

Dr. Nathaniel Chapman, so far as I can learn, was the first in this city thus to enlarge the facilities for his office-students. In 1817 he associated with himself Dr. Horner (on Anatomy), and they occupied a room over his stable (a rather favorite place, it would seem, for anatomists), in the rear of his house, on the south side of Walnut Street, the second door below Eighth. In 1819–20 Dr. Dewees joined them, and soon after, Drs. Hodge, Bell, Jackson, J. K. Mitchell, and for some time Dr. T. P. Harris. This afterwards became the "Medical Institute," obtained a charter, and erected a building in Locust Street above Eleventh, afterwards occupied, from 1846 to 1848, by the "Franklin Medical College."

In 1818 Dr. Joseph Parrish began a similar association with Dr. George B. Wood, and afterwards also with Drs. Richard Harlan and Shoemaker. From this, in 1830, arose the "Philadelphia Association for Medical Instruction," consisting of Drs. Parrish, Wood, Samuel George Morton, John Rhea Barton, and Franklin Bache, who were joined at various times by Jacob Randolph, W. W. Gerhard, Joseph Pancoast, and William Rush. For six years the association continued its labors; but, then, as some grew in years and practice, and others were absorbed by the colleges, it was dissolved. The "School of Medicine" was a third similar organization formed about the same time, in which were Drs. William Gibson, Jacob Randolph, B. H. Coates, René La Roche, John Hopkinson, and Charles D. Meigs. Meigs and Bache held a peculiar relation, for Bache, of the "Philadelphia Association," admitted also the students of the "School of Medicine" to his lectures on Chemistry, and Meigs, of the rival school, in return, admitted the students of both to his lectures on Obstetrics. Nearly all of those I have named became professors in the University or the Jefferson, and of them all, alas, only George B. Wood, Joseph Pancoast, and B. H. Coates survive!

In 1842, while Dr. Joshua M. Allen was at the head of the Philadelphia School of Anatomy, the second "Philadelphia Association for Medical Instruction," generally known as the "Summer Association," was formed, for the purpose of giving lectures during the long recess in the colleges from March to November. It consisted, originally, of Drs. John F. Meigs, on Obstetrics; Joshua M. Wallace (the brother of Prof. Ellerslie Wallace), on Surgery; Robert Bridges, on Chemistry; Francis Gurney Smith, Jr., on Physiology; and Joshua M. Allen, on Anatomy. The lectures were given in the eastern building till about 1847, when they changed to the western one, and in 1854 to Butler's Avenue,* in the rear of the Jefferson Medical College. Here they continued till 1860, when they disbanded. In 1845, when Dr. Meigs began to lecture on Diseases of Children, Dr. D. H. Tucker followed on Obstetrics, and, in 1850, on the latter's removal to the Richmond Medical College, as Professor of Obstetrics, he was followed by Dr. William V. Keating. At Dr. J. M. Wallace's death, the surgical lectureship was filled by the appointment of Dr. J. H. B. McClellan in 1851, Dr. Addinell Hewson in 1853, and Dr. John H. Brinton in 1860. Dr. Bridges, though elected to the College of Pharmacy meantime, retained his lectureship on Chemistry from 1842 to 1860,—the only constituent member of the Association who remained to its close. In Anatomy, when Dr. Allen became Professor of Anatomy in the Pennsylvania College, in 1852, Dr. Ellerslie Wallace, then also Demonstrator of Anatomy, and since Professor of Obstetrics, in the Jefferson, became his successor. Dr. F. G. Smith continued to lecture

* This little street is now covered by part of the new Hospital of the Jefferson Medical College.—(W. W. K., 1905.)

on Physiology till 1852, when he was elected to the Professorship of Physiology in the Pennsylvania College, and was succeeded by Dr. S. Weir Mitchell who served until 1860. The first lecturer on Practice was Dr. Alfred Stillé, who joined the Association in 1844, and resigned in 1850, on account of ill health. In 1854 he became Professor of Practice in Pennsylvania College, and now fills so admirably the same chair in the University. He was succeeded by Dr. John F. Meigs from 1850 to 1854, and he, again, in 1855, by Dr. Moreton Stillé, the brother of Alfred Stillé, and already widely known as the joint author of "Wharton and Stillé's Medical Jurisprudence." A career of great prominence was then suddenly cut short by a sad accident. A decomposing subject left in the lecture-room from Friday till Monday, in July, so poisoned the air that Stillé and several of the class were made faint and sick. Stillé lectured as long as he could, but finally was compelled to yield, went home, and, after a brief illness, died from pyæmia. The next year the place was filled by Dr. J. M. Da Costa, now Professor of Practice at the Jefferson. Dr. Francis West—who will forget his fine face and courtly manners?—lectured on Materia Medica from 1844 till 1859, when Dr. James Darrach succeeded him. On Diseases of Children Dr. John F. Meigs was the only lecturer from 1840 to 1850, and on Medical Jurisprudence, Dr. Edward Hartshorne from 1847 to 1849.

Besides their duties in the association, several of the members also gave independent courses. Thus, Dr. Brinton gave private courses on Operative Surgery, and lectured on general surgical subjects from 1853 to 1861, and laid the foundation for his later reputation, both as Clinical Surgeon to the Philadelphia Hospital and Lecturer on Operative Surgery in the Jefferson. He occupied the third story or garret of the eastern building, a room which was destroyed when a new and flat roof was put on the building, about 1864. Many a night did I dissect there as a student till midnight, with no companions save the cadavera and the hungriest of rats. They were scarcely afraid of the living, much less of the dead. When Dr. Mitchell was experimenting here on his snakes, wishing sometimes to work till late into the night, and his stock of candles being low, he would only light a frugal stump when an observation had to be made and recorded. In the intervals of darkness the rats would swarm all over the room and the tables, and scarcely scamper away when wierdly lighted up by the great bowl of his meerschaum. So hungry were they that on one occasion, when one of my fellow office students fell into an alcoholic sleep on the table, mistaking him for a cadaver (for Dr. Brinton always used alcohol for preserving his subjects), they gnawed through his boots, and only awakened him when they had made slight progress on his toes.

While at work here Dr. Brinton repeated Suchet's experiments on tanning muscles after injecting gelatin, discovered the method of preserving fresh preparations by applying gutta-percha dissolved in benzole, dissected over one hundred sterna for his paper on "Dislocations of the Sternum," and discovered the valve in the right spermatic vein, one of the few discoveries recorded in macroscopical human anatomy of late years.

Dr. Da Costa also gave private courses on Physical Diagnosis from 1854 to 1863. Such was his reputation when I attended them, a year before their close, that he was compelled to refuse many anxious applicants, lest the classes should become unwieldy for that method of personal instruction, and such his diligence that here were begun the numerous observations for his unrivalled later work on "Diagnosis." Here, also, most of the actual laboratory and experimental work was done for papers on "The Pathology of Acute Pneumonia," "The Effects of Respiration on the Size and the Position of the Heart," on "Blowing Sounds in the Pulmonary Artery," on "The Morbid Anatomy and Symptoms of Cancer of the Pancreas," and on "Serous Apoplexy." At the same time, also, he translated Köllicker's "Microscopical Anatomy" from the German.

The front room on the lower floor, and afterwards that in the second story, were occupied by Dr. S. Weir Mitchell as his Physiological Laboratory. Besides his lectures on Physiology in the Association, from 1853 to 1860, he gave, in 1856, the first purely experimental course on Physiology in the city, and also made in these rooms nearly all of his extremely important physiological experiments and discoveries. Here (for sentimental philocanism was not yet a feminine fashion) dogs, cats, pigeons, goats, guinea-pigs, turtles, rabbits, ducks, geese, mice, rats, and last, but not least, sundry snakes, copper-heads, moccasins, and rattlers, were his familiars within, while gaping crowds of swarming children with eyes and ears intent were only too familiar without. Beginning in 1853, his first important paper was the joint work of Dr. William A. Hammond and himself on "Corroval and Vao." Then followed his unexpected and valuable discovery of Saccharine or Diabetic Cataract. From 1857 to 1861 he was engaged more or less continuously on his well-known work on "Snakes and Snake-venom,"—a work which, after a series of years, the English observers have taken up in India with the result of confirming and extending, but in no important particular of reversing his own conclusions. Among them the most brilliant was his discovery of the corroding action of the venom on the blood-vessels. In 1860 and 1861 I was his assistant, and again in 1867 and 1868 in renewed experiments on the same subject.

Many are the amusing stories that could be told of such somewhat perilous work; of the rude and insecure boxes in which they were received, sometimes a section from the hollow trunk of a tree battened at each end, with scanty nails; of the suddenly discovered escape of a snake or two on more than one occasion,—a discovery none the less disquieting from the fact that no antidote had as yet been found; or of the janitor who, one night, when locking up, being slightly mystified by sundry potations, and treading on a headless snake who rattled vigorously and struck him with his stump, ran to a brick pile near by, and, filling his arms with the bats, let fly at random into the dark room (he had more than St. Patrick's aversion to snakes), and bottles, crucibles, costly thermometers, and two weeks of carefully prepared results were in the morrow's woeful count of cost. Many were the assistants who came, and, not liking the work, quietly disappeared; one of them, however, rather hurriedly, for he sat down all unconscious upon a lighted cigar, and leaning rudely against the snake-box started them to rattling just as the cigar burned through, when, leaping up in affright, he ran away, crying, "I'm bitten! I'm bitten!" and was seen no more. On another occasion, just as the snake was about to strike him, a dog tore himself loose and went flying out Chant Street, dragging a long chain behind, while the experimenters, with their long black gowns flying all abroad, rushed after him in the vain hope of a successful chase. It so happened that they were just raising the statue of Franklin into place in front of the Franklin Market, now the Mercantile Library, and among the lookers on, leaning against the church, was one of Penn's most placid followers. The swaying chain coiled itself like another snake around the leg of the unsuspecting observer, and arrested the dog's rapid flight to the detriment of his friend's centre of gravity. But the sight of his pursuers lending vigor to his struggles, with a yelp and a tug he rasped the cuticle off his groaning victim and flew up Tenth Street. Two weeks afterwards the physiologist and the canine encountered each other on the street. The recognition was mutual, and, as the dog darted away, his owner remarked to a friend alongside, "He's gone on werry queer since he got back!"

The speedy disposition of so many uninjected animals in summer, when the work was mainly done, presented many serious obstacles, until, at last, during the régime of one ingenious assistant (who generally superintended such matters), nothing was heard of them either in the way of trouble or expense. On inquiry, a true stroke of genius was discovered. The baggage trains of the Pennsylvania Railroad used to go out Market Street at night, and he simply tied them by a rope to the tail of the train. Those dogs never needed sepulture.

It can now be easily understood how not so much even as a chip has ever been stolen from me with such occupants in the building, both dead and alive, although the inhabitants of Chant Street, when I first began teaching, consisted largely, as Bret Harte has described them, of "blazing ruins," and though the door has often gone unlocked and the cellar was almost always accessible. Even a former office-boy (of African extraction) could never be induced to put foot inside the building, alleging that "he'd heerd of their layin' for colored boys before now!"

After finishing his investigations on serpents, Dr. Mitchell experimented largely on Woorara, and published a paper on the results. In 1862–63 he investigated the Chelonia, and found that their respiration was mammalian and not batrachian in type, and, with Dr. George R. Morehouse, he discovered the extraordinary chiasm in their inferior laryngeal nerves, the only nervous chiasm known, save the optic. In 1867–68 he investigated especially the effects of extreme cold on the nerves and nerve-centres, and in 1869 his extended experiments on the cerebellum were made, when he preserved a pigeon without any cerebellum for the before unexampled period of nine months.

No more brilliant corps of teachers, perhaps, has ever been gathered in this city than this old "Summer Association." Tucker became Professor of Obstetrics first in Franklin College and then in Richmond; Keating went to the Jefferson; Bridges to the Franklin College and the College of Pharmacy; Allen, as Professor of Anatomy, to the Pennsylvania College; Ellerslie Wallace, first as Demonstrator of Anatomy, and then Professor of Obstetrics, to the Jefferson; Francis Gurney Smith, to the chair of Physiology in the Pennsylvania College, and then to the University of Pennsylvania; Alfred Stillé, to that of Practice in Pennsylvania College, and then to the University; Da Costa, to the chair of Practice in the Jefferson; Mitchell here formed that habit of exact scientific observation and sagacious deduction which has given him a reputation on two continents, while Meigs, McClellan, Hewson, Brinton, Darrach, and Hartshorne have all become well-known hospital teachers and practitioners.

As writers, too, during this period, few men have been busier. Besides the books and papers I have already noted among the direct results of their labors here, I mention the following: Dr. Tucker wrote his "Principles and Practice of Midwifery." Dr. Alfred Stillé published a part of his lectures under the title of "Elements of General Pathology," while the lectures on Practice most carefully and "elaborately written out have formed the foundation of all those upon the same subject which he has since delivered." He also published his "Medical Institutions of the United States" and his "Report on Medical Literature," and with Dr. Meigs translated Andral's "Pathological Hæmatology." Dr. John F. Meigs published his lectures on "Diseases of Children," the well-thumbed book of multitudes of practitioners, now grown to be a most portly volume. Dr. F. G. Smith translated Barth and Roget's "Manual of Auscultation and Percussion," and edited Carpenter's various physiological works, Kirkes's and Paget's "Physiology," and Churchill on "Obstetrics." Dr. Keating edited Ramsbotham's "Obstetrics," and Churchill on "Children"; Dr. Bridges edited Fownes's "Chemistry"; Dr. Hewson edited Mackenzie on the "Eye," and Wilde on the "Ear," and all of them wrote numerous papers, reviews, etc., and also practised medicine! Truly they were busy men.

In 1855, during Dr. Agnew's administration, another association was started, which, like the one just named, was called after an older one, already noticed, the "Pennsylvania Academy of Medicine." It consisted of Drs. W. W. Gerhard, Henry H. Smith, D. Hayes Agnew, Bernard Henry, R. A. F. Penrose, and Mr. Edward Parrish, the son of Dr. Joseph Parrish, who lectured on Practical Pharmacy, and the next year they were joined also by Dr. Edward Shippen. For two years they continued as an association of lecturers, then Drs. Gerhard, Agnew, Penrose, and Mr. Parrish went on as a Quiz association for a year, when they disbanded. Dr. Agnew gave his usual courses in the School of Anatomy, and Dr. Penrose continued to lecture here on Obstetrics until called to the University in 1863. They were equally fortunate in promotion with the members of the other association, for four of the seven went to the University as professors: Gerhard on Clinical Medicine, Henry H. Smith and Agnew as Professors of Surgery, and Penrose on Obstetrics. Mr. Parrish, in an Introductory to the course of 1857, "On Summer Medical Teaching in Philadelphia," has given the only brief sketch of the Philadelphia School of Anatomy and some of the associations and teachers I have noticed, that has ever appeared.

Besides these distinct associations for lecturing, numerous other independent experimenters and lecturers have availed themselves of the facilities it afforded, scanty as they have often been, for their work. Before my own day I have been able to learn the names of only a few: but these are of interest. In 1849 Dr. Brown-Séquard gave his first lecture in America in this room to Dr. Francis Gurney Smith's class in physiology in the "Summer Association." It was on the Physiology of the Nervous System; and during the lecture, with that extraordinary manual dexterity for which he is noted, he cut the anterior and posterior roots of the spinal nerves in some frogs, and demonstrated the cross-sensibility of the spinal marrow by sections of its lateral halves in the guinea-pig. This was followed by a course to the physicians of the city. His next course was given in the Franklin Institute. About this time, also, Dr. John Hastings of the Navy gave some lectures on yellow fever, apropos of the then existing epidemic, based on his personal observations during the Mexican war. In 1859, Dr. S. W. Gross, while one of Dr. Agnew's demonstrators, gave courses on Operative Surgery and Surgical Anatomy, and again in 1866–67. In 1860, and for some time afterwards, Dr. John W. Lodge gave courses in Experimental Physiology in the summer, and on Urinary Pathology in the winter. In Obstetrics, Dr. J. M. Corse also lectured here. In 1864–67 Dr. J. M. Boisnot, and also, in 1865–66, Dr. J. Bernard Brinton, each gave courses in Operative Surgery.

Since I have had charge of the school, Dr. Isaac Ott has experimented on cocaïne and other poisons, and Dr. H. C. Wood, Jr., on the physiological action of the alkaloids of veratrum viride, until my landlord complained of the barking dogs with such energy that I was fearful of summary ejectment. I well remember, too, among other odors, the persistent, and it seemed almost imperishable, smell from a seal which Dr. Harrison Allen dissected here some years ago. Besides these, the following regular courses of lectures have been given here: on Obstetrics, Dr. F. H. Getchell and W. F. Jenks; on the Microscope, Dr. James Tyson; on Operative Surgery, Dr. Hodge gave independent courses, from 1868 to 1870, in the eastern building; on Bandaging and Fractures, Drs. J. Ewing Mears and O. H. Allis; on Physical Diagnosis, Drs. John S. Parry, O. P. Rex, Stanley Smith, and Hamilton Osgood; on Venereal Diseases, Dr. William G. Porter; on Ophthalmology, Drs. George C. Harlan, George Strawbridge, and W. W. McClure; and on Laryngoscopy, Dr. J. Solis Cohen. For a number of years, also, the Naval Examining

Board examined all their candidates for admission and promotion here.

Of the various quiz associations I have been able to learn but little beyond my personal knowledge. That which followed the Academy of Medicine I have already named. In 1837 Dr. E. G. Davis quizzed on all the branches himself, as I learn from an old circular, as also, at first, was Dr. D. D. Richardson's habit. Dr. Richardson's quiz lasted from 1860 to 1871, and in the last few years he was assisted by Drs. Boisnot, Cohen, and Witmer. He had as many as eighty pupils. From 1866–68, I quizzed with Drs. Duer, Dunglison, and Maury; 1868–69, with Drs. Warder, McArthur, Leaman, and Mears; and from 1869 to 1872 with Drs. Hutchins, Allis, Rex, Getchell, Leffman, and Loughlin. This winter Drs. Wilson, West, Greene, and Osgood occupied this room. From 1869 to 1871, also, the eastern building was occupied by the quiz of Drs. Willard, Curtin, Cheston, Jenks, Wilson, and Githens. Of these numerous medical men many have already attained distinction; the rest deserve it, and with years no doubt will win it.

The Janitors deserve a passing word. They have been mostly apostolic in name (as well as somewhat over-obedient to the apostolic injunction to Timothy), for two Johns and two Jameses have occupied the post for some forty years of its history. One, whom most of the older graduates will remember, was here for about twenty-five years. Crabbed and cross, yet a favorite withal, versed in all subject-lore beyond his fellows, he was only once baffled. When the two buildings were rivals and subjects unusually scarce, a fresh cadaver was stolen from this building at night and conveyed across the roof to the other. Being too closely guarded for another Stygian journey back, and the offense not being indictable at law, even he was foiled. He alternated from being a whisky-barrel in the morning to a barrel of whisky in the evening, and it was always supposed that he died of spontaneous combustion, like old Krooks in "Bleak House," till I learned lately that he stuck to his colors to the last, and died from drinking the alcohol from specimens.

Such, in brief, is the history of this now somewhat venerable school, and of the many teachers associated with it.* I can count eighty-five teachers who have won their spurs in its lecture-rooms, formed here their habits of thought, style of lecturing, methods of scientific research, and gained their early fame as writers and teachers, so that twenty-seven have become professors in sixteen medical colleges, here and elsewhere, and fifty-one hospital and clinical physicians, surgeons, obstetricians, etc., of distinction. Thirty-two books have been written or edited, eleven pamphlets and not less than thirty papers of value have been published by its various teachers. Its Assistant Demonstrators are too numerous for me even to mention. Its students I cannot trace. Most of them are personally unknown to me. But this I know, that, spread all over the world, doing faithfully their daily work, in relieving the suffering, soothing the dying, helping the poor, assuaging the pestilence that walketh in darkness, improving the public health, advancing the domain of pure and applied science, teaching earnestly its results to thousands of eager students, who, in turn, will swell their noble ranks, promoting in general the moral and material welfare of mankind, some in lofty, some in lowly station, they will confess that here they first developed their scientific tastes and aspirations; here they were taught to look beyond the lower to the highest and noblest aims of our profession; here they first caught the inspiration that has made them what they are; and that they will think kindly of the dear old school and its faithful teachers, and it may be even drop a tear of regret when they learn that the Philadelphia School of Anatomy is only a thing of the vanished past.

* Mr. F. Gutekunst, 712 Arch Street, has photographed the building for any who may desire to obtain such a memento.

OUR RECENT DEBTS TO VIVISECTION.*

[After a few introductory remarks appropriate to the special occasion the address continued as follows.]

TO one of these medical issues of the day I purpose to direct your attention at present—one as to which intense feeling, especially among women, has been aroused, —viz., the question of experiments upon animals.

Epithets and invective have been freely used, but, as befits the audience and the occasion, I shall endeavor to approach it in a perfectly calm and fair spirit, seeking to lay before you only one aspect of a many-sided question,—viz., the actual practical benefits it has conferred upon man and animals— a fact that is constantly denied, but which medical evidence proves to be incontestable.

I shall not consider the important older discoveries it has given us, but only those since 1850, almost all of which are within my own personal recollection. Even of these I must omit nearly all of its contributions to physiology and to pathology, though so much of our practice is based upon these, and confine myself to the advances it has enabled us to make in medical and surgical practice. I shall endeavor to state its claims with moderation, for an extravagant claim always produces a revulsion against the claimant, and is as unwise as it is unscientific.

Again it must be borne in mind that, as in nearly every other advance in civilization and in society, so in medicine, causes are rarely single, put generally multiple and inter-

* The address to the graduates at the Thirty-third Commencement of the Woman's Medical College of Pennsylvania, March 11, 1885.

woven. While vivisection has been a most potent factor in medical progress, it is only one of several factors the disentanglement of which and the *exact* balancing of how much is due to this or to that are often difficult and sometimes impossible. Let me add one word more. All that I may say is purely upon my own responsibility. I commit the opinion of no one else to any view or any statement of fact.

Medicine in the future must either grow worse, stand still, or grow better.

To grow worse, we must forget our present knowledge—happily, an inconceivable idea.

To stand still, we must accept our present knowledge as a finality, complacently pursuing the well-worn paths; neither hoping nor trying for anything better—happily, again, an impossibility.

To grow better we must try new methods, give new drugs, perform new operations, or perform old ones in new ways; that is to say, we must make experiments. To these experiments there must be a beginning: they must be tried first on some living body, for it is often forgotten that the dead body can only teach manual dexterity. They must then be tried either on an animal or on *you*. Which shall it be? In many cases, of course, which involve little or no risk to life or health, it is perfectly legitimate to test probable improvements on man first, although one of the gravest and most frequent charges made against us doctors is that we are experimenting upon our patients.

But in many cases they involve great risk to life or health. Here they cannot, nay, they must not, be tested first upon man. Must we, then, absolutely forego them, no matter how much of promise for life and health and happiness they possess? If not, the only alternative we have is to try them on the lower animals, and we would be most unwise—nay, more, we would be cruel, cruel both to man and to animals—if we refused to pain or even to slay a few animals, that thousands, both of men and of animals, might live.

Who would think it right to put a few drops of the hydrochlorate of cocaïne (a year ago almost an unknown drug) into the eye of a man, not knowing what frightful inflammation or even loss of sight might follow? Had one dared to do it, and had the result been disastrous, would not the law have held him guilty and punished him severely, and all of us have said Amen? But so did Christison with Calabar bean, and well-nigh lost his own life. So did Toynbee with prussic acid on himself, and was found dead in his laboratory.* According-

* I add the following striking extract from a speech in defense of vivisection, on April 4, 1883, by Sir Lyon Playfair, deputy Speaker of the House of Commons—no mean authority. The italics are my own:

"For myself, although formerly a professor of chemistry in the greatest medical school of this country, I am only responsible for the death of two rabbits by poison, and I ask the attention of the House to the case as a strong justification for experiments on animals, *and yet I should have been treated as a criminal under the present act had it then existed.* Sir James Simpson, who introduced chloroform—that great alleviator of animal suffering—was then alive and in constant quest of new anæsthetics. He came to my laboratory one day to see if I had any new substances likely to suit his purpose. I showed him a liquid which had just been discovered by one of my assistants, and Sir James Simpson, who was bold to rashness in experimenting on himself, desired immediately to inhale it in my private room. I refused to give him any of the liquid unless it was first tried upon rabbits. Two rabbits were accordingly made to inhale it; they quickly passed into anæsthesia and apparently as quickly recovered, but from an after-action of the poison they both died a few hours afterwards. *Now, was not this a justifiable experiment upon animals? Was not the sacrifice of two rabbits worth saving the life of the most distinguished physician of his time?* . . . Would that an experiment of a like kind on a rabbit or a guinea-pig had been used by John Hunter, who probably shortened his own noble life by experimenting on himself! . . .

"Let me give one other instance. . . . A few years ago two young German chemists were assistants in a London laboratory. They were experimenting upon a poison which I will not even name, for its properties are so terrible. It is postponed in its action, and then produces idiocy or death. An experiment on a mouse or a rabbit would have taught them the danger of this frightful poison; but in ignorance of its subtle properties, they became its unhappy victims, for one died and the other suffered in-

ingly, Koller, of Vienna, properly and wisely tried cocaïne first on animals,* and then, finding its beneficial effects, tried it upon man with like results, and one of the most remarkable drugs of modern times was thus made available. We are only on the threshold of its usefulness. It has been used in the eye, the ear, the nose, the mouth, the larynx, and all other mucous membranes, in the removal of tumors, and as an internal medicine. When its physiological action has been still more thoroughly and systematically investigated, its poisonous dose ascertained, when we know how it works, what its effects are upon the blood-pressure, the heart, the nerves, the blood-vessels—effects that can not be accurately studied upon man—its usefulness may be increased to an extent as yet but little dreamed of. Should it only soothe the last painful hours of our great hero, General Grant, a nation will bless it and the experiments which gave it effect. Moreover, had the experiments of Dr. Isaac Ott, of Easton,† on this very drug, borne their due fruit, America would have had the honor and the human race the benefits of cocaïne ten years ago—ten years of needless suffering!

This is but one illustration of the value of experiments upon animals in the realm of new drugs. In fact, substitute for cocaïne other drugs, or new operations, or new methods of medical treatment, and the argument repeats itself for each. Within the last thirty years a multitude of new drugs have thus been discovered, and their effects have been either first tested upon animals, or their properties studied exhaustively in a manner impracticable upon man. I will only enu-

tellectual death. Yet the promoters of this bill would not suffer us to make any experiments on the lower animals *so as to protect man* from such catastrophes. It is by experiments on animals that medicine has learned the benefits, but also has been taught to avoid the dangers of many potent drugs—as chloroform, chloral, and morphia."

* Archives of Ophthalmology, Sept. and Dec., 1884, p. 402; New York, Putnam's.

† Ott, Cocaïne, Veratrine, and Gelsemium, Philadelphia, 1874.

merate some of them, since time will not allow me to enter upon each in detail. Thus have been introduced lily-of-the-valley in heart disease, yellow jasmine, in diseases of the heart and nervous system, paraldehyde and chloral hydrate, so valuable for sleep, caffeine for headache, eucalyptus as an antiseptic and in medicine, nitroglycerine for nervous maladies, Calabar bean for disease of the eye and nervous system, naphthaline and iodoform in surgery, quebracho as an antispasmodic, antipyrine and kairine in fever, jaborandi in dropsy, salicylic acid in rheumatism, nitrite of amyl in epilepsy and intermittent fever, jequirity in ophthalmic surgery, piscidia as a substitute for opium, the hypodermatic method of using drugs, and so on through a long list. And, as to the old drugs, it may be truly said that we have little exact—that is, scientific—knowledge of any one except through experiments upon animals.*

Let us now see something of what America has done in advancing practical medicine by vivisection. In passing, I may say that the assertion that America has contributed but little, so far from being an argument for the restriction of vivisection, is a strong argument for its further cultivation, in order that greater good may result from remarkable discoveries here, equal to those that I shall show have been made in Europe.

* For three hundred years digitalis, for instance, has been given as a *depressant* of the heart, and, when a student, I was taught to avoid it carefully when the heart was weak. But the accurate experiments of Bernard and others have shown that it is, on the contrary, actually a *heart tonic and stimulant.* So long as I live I shall never forget the intense joy of myself and the agonized parents, when one bright young life was brought back from the very grave, some five years ago, by the knowledge of this fact, and this is but one of many such cases. Thus have the action and dangers of our common anæsthetics been positively and accurately ascertained; thus the action of ergot on the blood-vessels, explaining alike its danger as an article of food and its wonderful use in certain tumors of the uterus and diseases of the nervous centres; thus, too, every one who gives opium in its various forms is a debtor to Bernard, and every one who gives strychnine a disciple of Magendie.

Wounds of the abdomen, especially gunshot wounds, are among the most fatal injuries known to surgery. A small, innocent-looking, external pistol wound may cover multiple and almost inevitably fatal perforations of the abdominal viscera. The recoveries from 3717 such wounds during the late Civil War only numbered 444, and of those with escape of the intestinal contents the recoveries, says Otis, may be counted on one's fingers. The prevailing treatment as laid down in our text-books has been purely conservative, treating symptoms as they arise. The brilliant results achieved in other abdominal operations have led a few bold spirits, such as our own Sims, Gross, Otis, McGuire, and others, to advocate the opening of the abdomen and the repair of the injuries found.

In May of last year, Parkes, of Chicago, reported to the American Medical Association* a serious of systematic experiments on thirty-seven dogs, that were etherized, then shot, the abdomen opened, and the wounds of the intestines, arteries, mesentery, etc., treated by appropriate surgical methods. The results confirmed the belief awakened by earlier experiments and observations that surgery could grapple successfully with multiple and formidable wounds, by sewing them up in various ways, or even by removing a piece of the bowel and uniting the cut ends. Hard upon the heels of this important paper, and largely as its result, comes a striking improvement in practice. And remember that this is only the first fruit of a rich harvest for all future time, in all countries, in peace and in war.

November 2d, of last year, a man was brought to the Chambers Street Hospital, in New York, with a pistol-shot wound in the abdomen. Under careful antiseptic precautions, and following the indications of Parkes, the abdomen was opened

*Medical News, May 17, 1884. I shall refer readers frequently to this journal, as it is often more accessible than foreign journals, and it will refer them to the original papers.

by Dr. Bull,* coil after coil of the intestines was drawn out, the bullet was found and removed, and seven wounds of the intestines were successively discovered and properly treated, and the patient made an uninterrupted recovery. A recovery, after so many wounds, any one of which would necessarily have been fatal under the old methods of treatment, shows that we have now entered upon a proper and successful method of treatment for such frightful accidents.†

This is but one of the remarkable achievements of late years in abdominal surgery. The spleen has been removed, part of the stomach has been cut out for cancer,‡ part of the bladder § has been dissected away, the entire gall-bladder has been removed, and several inches of the intestine have been cut out, ‖ all with the most remarkable success. To all of these, experiments upon animals have either led the way or have taught us better methods. To recite each in detail would occupy too much time, but one illustration I must not omit, for the improvement, produced by it and other experiments, affects every abdominal operation. When I was a student, the peritoneum was avoided by knife and needle wherever possible. After the death of his fourth case of ovariotomy, Mr. (now Sir Spencer) Wells,¶ in making the post-mortem, was led to believe that the then received treatment of the peritoneum was incorrect, and that he ought to bring its surfaces in contact in order to obtain secure union.

* Medical News, Feb. 14, 1885.

† Since 1885 hundreds of such wounds have been successfully treated and recovery has followed after as many as nineteen wounds of the bowels. —(W. W. K., 1905.)

‡ Since 1885 the entire stomach has been repeatedly removed.—(W. W. K., 1905.)

§ Since then the entire bladder has been repeatedly removed.—(W. W. K., 1905.)

‖ Much larger portions have been removed since then, even as much as eight feet eight inches, with success.—(W. W. K., 1905.)

¶ Wells, Ovarian and Uterine Tumors, 1882, p. 197.

Accordingly, instead of testing his ideas upon women, he experimented upon a few dogs, and found that his suspicions were correct. Since then it has been accepted as a cardinal point in all abdominal operations. Following this came improvements in the ligatures used, in the method of treating the pedicle, in the use of antiseptics, etc., all more or less the result of experiments upon animals, and what are the results? Taking successive hundreds of cases, Sir Spencer Wells's percentage of mortality has decreased steadily from thirty-four per cent. to eleven per cent.

Since then, others have reduced the percentage of deaths after ovariotomy to three in the hundred; and Martin, of Berlin, has lost but 1 patient from blood-poisoning in his last 130 cases.

It can not be claimed, of course, as to *all* this wonderful history of abdominal surgery—and remember that in 1862, when I was a medical student, I heard ovariotomists denounced from a professor's chair as murderers!—that experiments upon animals have done the whole work. No one man, no one series of experiments has sufficed, and experiment *alone* would not have done it. But had such experiments not been made on animals, as to the peritoneum, the pedicle, the sutures, the ligatures, etc., we should be far behind where we now are, and still be ignorantly sacrificing human life and causing human suffering.

But to return to America. The first condition to successful treatment is an accurate knowledge of what any disease is—its cause and its course; then we may guide it, and in due time, it may be, cure it.

Before Dr. H. C. Wood's* accurate experiments on the effects of heat on animals the nature and effects of sunstroke were almost matters of mere conjecture. Every one had his own theory, and the treatment was equally varied. Even the heat-effects of fever itself—the commonest of all symp-

* Wood, Thermic Fever or Sunstroke, Philadelphia, 1872.

toms of disease—were ill understood. Wood exposed animals to temperatures of 120° to 130° F. and studied the effects. These experiments have often been alluded to as "baking animals alive." You will note that the heat was no greater than that to which laborers are frequently exposed in our hot summer-days, when working in the sun or in many industrial works. His experiments showed that the effects of sunstroke—or, as he happily termed it, thermic or heat fever, a scientific name now widely adopted—were solely due to the heat, death following from coagulation of the muscular structure of the heart, or by its effects on the brain. They explained also many of the phenomena of ordinary fever as the result of heat alone. They have established the rational and now generally adopted treatment of sunstroke by reduction of the body-temperature; and the same method is now beginning to be appreciated and employed in ordinary fever.*

The same observer, with Dr. Formad, has made important experiments on the nature of diphtheria, and when we learn, as we probably soon shall, how to deal with the microscopical forms of life which seem to be its cause, it will not be too much to hope that we may be able to cope far more successfully with a disease now desolating so many homes.†

In India alone twenty thousand human beings die annually from snake-bite,‡ and as yet no antidote has been discovered. How can we *search intelligently* for an antidote until we know

*Eighteen out of Wood's experiments were on the general effects of heat, as above alluded to. In six others the local effects of heat (135° to 190° F.) on the brain, and in four others the local effects (up to 140° F.) on the nerves were studied and gave most valuable results, entirely and evidently unattainable on man.

† The remarkable results in lessening the mortality from diphtheria by the use of the antitoxine discovered since this address was published are now universally known. Thousands of human lives, especially of children, are saved annually in this country alone.—(W. W. K., 1905.)

‡ Fayrer, Thanatophidia of India, p. 32.

accurately the effects of the poison? This can not be studied on man; we must resort to animals, or else let the holocaust go on. Accordingly, Dr. T. Lauder Brunton began such a series of experiments in London, but was stopped by the stringent antivivisection laws there in force. But Drs. Weir Mitchell and Reichert,* in this city, have recently undertaken experiments on cobra and rattlesnake venom, the cobra-poison being furnished, be it observed, by the British Government, whose own laws have prevented investigations for the benefit of its own subjects! The results are as yet only partly made known, but they have been brilliantly successful in showing that there are two poisons in such venom, each of which has been isolated and its effects studied. The first step has been taken—the poison is known. Who will raise a finger to stop progress toward the second—the antidote? † Can the sacrifice of a few scores of animals each year in such research weigh for a moment against the continuous annual sacrifice of twenty thousand human beings? ‡

The modern history of anæsthetics is also of interest. To say nothing of ether and chloroform, whose safer use Bert has investigated in France, nor of cocaïne, to which I have already alluded, let us see what experiments on animals have

* Medical News, April 28, 1883.

† Since then Calmette and Noguchi have both discovered an antivenene or antidote to the venom of snakes.—(W. W. K., 1905.)

‡ I am permitted by Rev. R. M. Luther, of this city, to state the following fact in illustration of the practical value of vivisection in snake-bite: When a missionary in Burmah, he and his brother-in-law, Rev. Mr. Vinton (two missionary vivisectionists!), made a number of experiments to discover an antidote to the poison of the "brown viper"—a snake but little less venomous than the cobra. They found a substance which is an antidote in about sixty per cent. of the cases if applied at once Thah Mway, one of their native preachers, when bitten by the brown viper, had some of this antidote with him, and by its use his life was saved when on the verge of death. This one life saved, it is estimated, has been the means of leading two thousand Karens to embrace Christianity. Was not this one life worth all the dogs used in the experiments—to make no mention of the many other lives that will be saved in all the future?

shown us as to bromide of ethyl—an anæsthetic lately revived in surgery. Its revival has quickly been followed by its abandonment on account of the frequent sacrifice of human life—that is to say, *experiments on human beings* have proved it to be deadly. Now, Dr. H. C. Wood,* soon after its reintroduction, made a study of its effects on animals, and showed its physiological dangers. Had his warnings been heeded, not a few human lives would have been saved.

The ideal anæsthetic, that will abolish pain without abolishing consciousness, and do so without danger, is yet to be found. Cocaïne is our nearest approach to it. Now, in all fairness and common sense, would it be real kindness or real cruelty to obstruct the search for such an anæsthetic—a search which will surely be rewarded by success, but which, if not carried on by experiments on animals, must be tried by deadly experiments upon man, or else be entirely given up?

In 1869 I was called to see a man suffering to the last degree from an abscess in the loin. I recognized the fact that it arose from the kidney, but I was powerless. All that I could do was to mitigate, and that, alas! but little, his pitiless sufferings till death came to his relief, after nearly a year of untold agony. I have never forgotten his sufferings, nor the sharp pain I felt when I learned, two years later, how I might possibly have saved his life. In the very same year (1869), Simon, of Heidelberg,† had a woman under his care suffering from urinary fistulæ from a healthy kidney—a surgical accident he in vain tried to heal. That she could live with one kidney had the other gradually been disabled by disease was probable, for one such diseased kidney had been already removed three times when mistaken for ovarian disease. But no one had removed a healthy kidney, and then studied the effects on the remaining kidney and upon the heart; no one had tested what was the best method

*Philadelphia Medical Times, April 24, 1880.

† Simon, Chirurgie der Nieren, 1871, preface.

of reaching the kidney, whether by the abdomen or the loin, or how to deal with its capsule, or the hæmorrhage, or the surgical after-effects. Of course, Simon could have tried the experiment on his patient, blindly trusting to Providence for the result. But he chose the wiser course. He studied the previous literature, experimented on a number of dogs and watched the points above noted, tried various methods of operating upon the dead body, and, after weighing all the *pros* and *cons*, deliberately cut down upon the kidney of his patient after a carefully formulated plan, not by the abdomen, but through the loin, and saved her life. She died in 1877, after eight years of healthy life, free from her loathsome disorder.

Now, what have been the results of these experiments upon a few dogs? One hundred and ninety-eight times the kidney has been removed, and 105 human lives have been saved; 83 times abscesses in the kidney have been opened, and 66 lives saved; 17 times stones have been removed from the kidney without a single death—or, in all, in the last fifteen years, 298 operations, and 188 human lives saved. Besides this, as an extension of the operation in 17 cases, in which the kidney, having no such attachments as ought to anchor it in place, was floating loosely in the abdomen and a source of severe pain, it has been cut down upon and sewed fast in its proper place; and all of these patients but one recovered.*

Looking to the future, when not hundreds, but thousands, of human beings will enjoy the benefits of these operations, and in increasing percentages of recoveries, are not the sufferings inflicted on these few dogs amply justified as in the highest sense kind and humane?†

* In the 20 years since this address was delivered these figures have been multiplied many fold.—(W. W. K., 1905.)

† Very erroneous views prevail as to the sufferings of animals from experiments upon them. Many persons suppose that "vivisection" means deliberate "cutting up" of an animal, little by little, till not enough

Not long since Dr. Ferrier, of London, was prosecuted for the alleged performance of certain experiments on the brains of the lower animals. With Fritsch, Hitzig, Goltz, Yeo, and others, he had destroyed or galvanized certain limited areas of the brain (and it must not be forgotten that the brain is wholly without the sense of pain), and so determined the exact nervous centres for certain limited groups of muscles. As a result of their labors, the brain is now mapped out with reasonable accuracy, so that, given certain hitherto ill-understood or obscure localized symptoms, we can now say that there is certainly a tumor, an abscess, or other disease in precisely this or that locality. True, we can doubtfully infer somewhat of the same from the cruel experiments of disease on man. But nature's experiments are rarely ever limited in area or uncomplicated; they are never systematic and exhaustive; it takes years to collect a fair number of her clumsy experiments, and the knowledge is diffused through many minds instead of being centered in one that will systematize the results.

Said Ferrier, a year ago, in the Marshall Hall Oration, "There are already signs that we are within measurable distance of the successful treatment by surgery of some of the most distressing and otherwise hopeless forms of intracranial disease, which will vie with the splendid achievements of abdominal surgery."

Note the fulfillment! Last fall, within a year of the foregoing prophecy, a man, aged twenty-five, entered the London

is left to live. So far is this from the truth, that Prof. Gerald Yeo, from the actual reports of vivisectionists in England (Fortnightly Review, March, 1882), estimates that of 100 such experiments, there are:

Absolutely painless	75
As painful as vaccination	20
As painful as the healing of a wound	4
As painful as a surgical operation	1
Total	100

Hospital for Epilepsy and Paralysis.* From the symptoms, which I need not detail, Dr. Hughes Bennett, basing his conclusions on Ferrier's experiments, diagnosticated a tumor of small size on the surface of the brain, involving the center of motion for the muscles of the hand. On November 15, 1884, at his instance, Mr. Godlee trephined the skull over the selected spot, and a quarter of an inch below the surface of the brain found a tumor as big as a walnut, and removed it. For three weeks the man did well, but died on the twenty-eighth day from blood-poisoning, such as might follow any operation, especially a new one. Macewen, of Glasgow,† has similarly trephined a woman, the victim of slow paralysis of body and mind, and opened an abscess a little distance below the surface, letting out two teaspoonfuls of pus, and followed by entire mental and physical recovery.

By these experiments and operations a wide door is open to surgery in the treatment of diseases within the skull—diseases heretofore so obscure and uncertain that we have hardly dared to attack them. The question is not whether death or recovery followed in these particular cases. The great, the startling, the encouraging fact is that, thanks to these experiments, we can now, with well-nigh absolute certainty, diagnosticate, and with the greatest accuracy locate such diseases, and therefore reach them by operation, and treat them successfully.‡ Would that I had been born twenty-five years later, that I might enjoy with you the full luxury of such magnificent life-saving, health-giving discoveries!

It is, however, by the experimental study of the effects of

* Medical News, Jan. 17, 1885. † Ibid., Jan. 3, 1885.

‡ In 1899—only fourteen years after this address was delivered—Knapp collected 491 operations for brain tumors in which the result was known. In 64 operations for palliation—i. e., relief of pain, etc.—only 4 died; in 275 completed operations 82 died (30 per cent.); in 152 inoperable and incompleted cases, 86 died (56 per cent.).—(W. W. K., 1905.)

minute organisms—microbes, as they are now called—that some of the latest and most remarkable results have been achieved. The labors of Koch, Pasteur, Klein, Cheyne, Tommasi-Crudeli, Wood, Formad, Sternberg, and others are now known even to the daily press. Let us see what they have done.

It is but three years since Koch announced that consumption was caused by the "bacillus tuberculosis." Later he had studied cholera and found the "comma bacillus," to which he ascribes that dreaded disease. In spite of the opposition of prominent scientists, his views have been in general accepted, and seem to be reasonable.

The method of experiment is simple, though difficult. The suspected expectoration or discharge is placed in a suitable soil, and after cultivation some of this growth is placed in another culture-soil, and so on till generation after generation is produced, the violence of the poison being modified by each culture. A small portion of any one of these cultures is then injected under the skin of a mouse or other animal, and in time it dies or is killed, and the results are verified by the post-mortem.

So exact is the knowledge in tuberculosis now that Koch can predict almost to an hour when the mouse will die of consumption, or that it will escape, according to the culture used.

It is far too early as yet to say that these studies have borne the immense practical fruit that the next few years will show; but they have already enabled us to recognize by the microscope doubtful cases of consumption in their earlier and more remediable stages, and have made certain what has hitherto been only a probability—that consumption is distinctly contagious.

By Gerlach's experiments on animals with the milk from tuberculous cows, also, it has been shown that consumption may be contracted from such milk. How important this conclusion is, in so universal an article of food to young and old, I need not do aught than state.

The experiments of Wood and Formad on diphtheria I have already alluded to. Those of Tommasi-Crudeli also have shown that probably the poison of malaria is due to like organisms, while a large number of other diseases are being similarly investigated.

As to cholera, the classic experiments of Thiersch, in 1853,* are well known. He inoculated 56 mice with cholera discharges. Of these, 44 sickened and 14 died from choleraic diseases. In the same year two water companies in London experimented on 500,000 human beings, one of them inoculating its patrons with cholera discharges through its impure water-supply. This one sickened thousands and killed 3476 human beings, most of whom might have escaped had the lessons of Thiersch's 14 mice been heeded. To ask the question, which was the more cruel, is to answer it.†

At present our strenuous efforts are all in one direction—viz., to study these microbes by the microscope, by clinical observation, and by experiments on animals, in order to find out their origin, causes, growth, and effects, and to discover by what means their deadly results may be avoided, or by what remedies, without harm to the patient, they may them-

* John Simon, Proceedings International Medical Congress, London, 1881.

† The population supplied by the Southwark and Vauxhall Company, in the epidemic of 1848–49 died at the rate of 118 in each 10,000, and, in that of 1853–54, at the rate of 130 per 10,000. Those supplied by the Lambeth Company died in 1848–49 at the rate of 125 per 10,000, but having improved its water-supply meantime, the death-rate, in 1853–54, fell to 37 per 10,000.

If Thiersch lived in England to-day, he would have to take out a license to kill his fourteen mice in the interests of humanity—a license possibly refused, or only to be obtained after the most vexatious delays. But any housemaid might torture and kill them with arsenic or phosphorus, or Thiersch might give them to a favorite terrier without the slightest interference, provided only it be not for a scientific or a humane object!

selves be destroyed. Evidently these studies can not be tried on our patients. They must either be tried on animals or be abandoned.

The inoculation experiments of modern times have recently borne rich fruit in still another pestilential disease—yellow fever—whose ravages in this country are fresh in our minds. November 10, 1884, M. Bouley reported to the Paris Academy of Sciences* that, since 1880, M. Freire, of Rio Janeiro, had experimented on guinea-pigs with the virus of yellow fever, and believed that he had been able to produce such attenuation of the virus that by vaccination he could secure immunity from this dreadful scourge. Following the experiments, he and Rabourgeon tested the results on themselves, some students of medicine, and employés. Later the Emperor Dom Pedro authorized two hundred wharf-laborers to be inoculated. All these, after a three days' mild attack, remained free from the pestilence, while their fellow-laborers, similarly exposed to the fever, were dying on every hand. If, in an epidemic, this still prove true, as there seems every probability it will, from the five hundred lives already saved, we can hardly estimate either the medical or the commercial advantages to this country alone. Is this cruelty? Let Norfolk, and Memphis, and Pensacola, and New Orleans answer.†

We are all familiar now with the numerous deaths from eating pork infested with trichina. While I was in Berlin, in 1865–66, a terrible epidemic of the then new disease broke out at Hedersleben, a small town in Prussian Saxony. I well remember with what zeal Virchow and his assistants im-

* Medical News, Nov. 29, 1884.

† Since then the brilliant researches of Major Reed, Colonel Gorgas, and other American army officers in Cuba have shown that the mosquito is the only source of propagation of yellow fever. The cause of yellow fever is still unknown, but mosquito bars have replaced these inoculations in guarding against the fever, as our knowledge has been augmented, and Cuba and the United States have been freed from this pestilence and its ravages among human beings and its commercial disasters.—(W. W. K., 1905.)

mediately investigated the disease, inoculated animals with the parasitic worm, studied its natural history, found out that heat killed it, and to-day, as a result of these and other experiments, we all know how to avert its dangers by proper cooking, or to avoid it altogether by the microscope. The value of these experiments, both to human life and to commerce, you know even from the daily papers.

You will find it difficult to make the non-medical public understand—nay, you yourselves as yet hardly understand—the enormous advance in medicine and surgery brought about by recent researches on inflammation, and by the use of antiseptics. My own professional life only covers twenty-three years, yet in that time I have seen our knowledge of inflammation wholly changed, and the practice of surgery so revolutionized that what would have been impossible audacity in 1862 has become ordinary practice in 1885.

It would seem that so old a process as inflammation would long ago have been known through and through, and that nothing new could be adduced. In 1851, however, Claude Bernard, by a slight operation, divided the sympathetic nerve in a rabbit's neck and showed its influence on the calibre of the blood-vessels. In 1858 Virchow published his "Cellular Pathology." In 1867 Cohnheim published his studies on the part that the blood-cells played in inflammation as shown in the frog, followed by further papers by Dr. Norris, of this city, Stricker, von Recklinghausen, Waldeyer, and many others. Already in my lectures I have pointed out to you in detail the advances made by these studies, both in theory and practice. They have brought about an entire reinvestigation of disease, and given us wholly new knowledge as to abscesses, ulceration, gangrene, the organization of clots in wounds, and after operations and ligature of blood-vessels for aneurism, as to thrombosis, and embolism, and paralysis, and apoplexy, and a score of other diseases through the diagnosis and treatment of which now runs the silver thread of knowledge instead of ignorance.

With this the brilliant results of the antiseptic system have joined to give us a new surgery. Sir Joseph Lister, to whom we chiefly owe this knowledge, has done more to save human life and diminish human suffering than any other man of the last fifty years. Had he only made practicable the use of animal ligatures, it would have been an untold boon, the value of which can only be appreciated by doctors; but he has done far more, he has founded a new system of surgery. We may reject the spray and carbolic acid, but the surgical world, regardless of details, with few exceptions follows the principles upon which his method is founded and humanity is the gainer, by the nearly total abolition of inflammation, suppuration, secondary hæmorrhage, blood-poisoning, gangrene, and erysipelas, as sequels of accidents and operations; by the relief from suffering and death, by operations formerly impossible; by rendering amputations and compound fractures safe and simple instead of deadly. Reflect on what each one of these brief, but momentous, statements means!

But we have by no means reached perfection. Lister himself, no tyro, but the great master, is still searching for further improvements. But when lately he desired to make some experiments on animals, still further to perfect our practice, so many obstructions were thrown in his way in England that he was driven to Toulouse to pursue his humane researches.

I had intended also to speak of many other practical benefits to man directly, but can only mention such important matters as the surgery of the thyroid gland, the seat of goitre; the surgery of the lungs, part of which have been removed; the surgery of the nerves, removal of the entire larynx, the remarkable researches of late years as to the periosteum in the reproduction of new bone after removal of dead or diseased bone; Bernard's important observations as to diabetes; Brown-Séquard's experiments on epilepsy, the modern extraordinary advance in nearly all the diseases of the nervous system, and a number of other discoveries, as to all of which experiments upon animals have added largely to our knowledge, and therefore to our means of diminishing suffering and saving human life. For many of these, as well as for the most judicial discussion of the vivisection question I have yet seen, I must refer you to that remarkable book, "Physiological Cruelty," written, not by a man, *but by a woman.**

I had also intended to refer in detail to the splendid results of vivisection in relieving the sufferings of animals, and in preventing enormous pecuniary loss to man. We are only beginning to see that vivisection is as humane to animal life and suffering as it is to human, and that for financial reasons as well as humane motives it is of the utmost importance to the State that such diseases as cattle plague, splenic fever, chicken cholera, swine plague, and others, should be eradicated. Vivisection has shown us how this may be done, and has so conferred upon animals, too, the boon of life and health. For all this, however, I must refer you to the recent admirable lecture by Prof. Robert Meade Smith, of the University of Pennsylvania.†

One subject, however, is so recent and of such interest, both to man and animals, that I must not pass it over—I mean that justly dreaded disease hydrophobia. Thanks to vivisection, its abolition in the near future seems no longer to be a matter of doubt.

Within the last three years Pasteur has announced that, by passing the virus through the monkey, he has been able to protect dogs from hydrophobia by vaccination with this weakened virus. The French government recently appointed

* See also the just issued Life and Labors of Pasteur.

† Therapeutic Gazette, Nov., 1884.

an eminent scientific commission to report on the alleged discovery.* Pasteur furnished them with 23 vaccinated dogs. These 23, and 19 others unprotected, were all inoculated from rabid animals. Of the 19 unprotected, 14 died. Of the 23 protected dogs, 1 died of diarrhœa, and all the others escaped. It has yet to be tried on a man suffering from hydrophobia, but, should our reasonable hopes be realized, what a boon it will be!†

With this brief summary of a few of the recent practical benefits from vivisection, I must close. I have given you only ascertained facts for your future use in the communities in which you may settle. They may assist you in forming public sentiment on a basis of fact, of reason, and of common sense. The sentiment of our own profession, so constantly and so conspicuously humane, are always against inflicting pain; but if in yielding to sentiment we actually increase disease, and pain, and death, both among animals and men, our aversion to present pain is both unwise and actually cruel.

* Medical News, August 30, 1884.

† In the last twenty years "Pasteur Institutes" for the treatment of hydrophobia and some similar diseases have been established in nearly every civilized country in the world. Of persons bitten by animals believed to be rabid, heretofore about sixteen per cent. developed hydrophobia, and *every one* died. In the thousands of such cases treated by Pasteur's method even those bitten by animals *known* to be rabid the mortality is *less than one per cent.*—(W. W. K., 1905.)

RECENT PROGRESS IN SURGERY.*

IN no department of medicine has there been more rapid and in many respects more astonishing progress in recent years than in surgery. This progress is due chiefly to two things—the introduction of antiseptic methods, and to what we have learned from laboratory work and experiments upon animals.

It has long been known that a "simple" fracture, in which the skin is unbroken, and a "compound" fracture, in which the skin is broken and the air has easy access to the fractured bone, were vastly different in their dangers; but *why* the communication with the air was so dangerous was a mystery. Of late years, however, the germs existing in the atmosphere, and on every material coming into contact with the wound, such as dirty clothing, ordinarily clean instruments, the skin of the patient, the hands of the surgeon, and the dressings, have been investigated by a large number of observers, and it has been abundantly proved that infection comes not from the wound itself, but from the exterior, and that this infection from without is the cause of inflammation and of its speedy sequel, the formation of "pus" (that is, "matter"). Once that the pus begins to form, fever, abscesses, blood-poisoning, gangrene, erysipelas, one or all, may start up into ominous and fatal activity. Inflammation and suppuration (that is, the formation of pus), then, are the causes of all these evil processes. They are all called briefly "septic" (that is,

* Reprinted from Harper's Magazine, October, 1889, by the kind consent of Messrs. Harper & Brothers.

"poisonous") processes. Hence "antiseptic" methods are those that prevent inflammation and suppuration.

Now we see why a compound fracture, or any other "open" wound (that is, one in which the protective defense of the skin is destroyed), is so much more dangerous than a simple fracture, or a subcutaneous wound. It arises from the fact that these septic germs, or "microbes," have easy access to the tissues, and, once there, multiply with almost incredible rapidity, and quickly set up inflammation and suppuration and their consequences. At first it was thought that the chief danger lay in atmospheric germs, but later investigations have proved that the skin of the patient, and especially the hands of the surgeon, and his instruments and sponges, and even his dressings, are far more frequent sources of infection.

Perhaps I cannot better illustrate the difference between the old, or "septic," and the new, or "antiseptic," surgery than by describing two amputations, one such as was commonly done, for instance, during the Civil War, and the other such as is done now by every good surgeon. In fact, it is only within the last ten or fifteen years that antiseptic surgery has become generalized in the profession.

Let us suppose an amputation above the elbow, and the operator the best surgeon of the Civil War. The arm was not specially prepared, except that it would be cleaned of its coarse dirt arising from the accident, but that would be all. The instruments were taken out of an ordinary case and placed on a table, and during the operation were frequently placed upon the patient's clothing, soiled often by the accident necessitating the operation, as well as by more or less wearing. If the instruments or sponges fell upon the floor, they would be picked up, dipped into water, and then used with innocent equanimity. The sponges, washed and dried from the last operation, were simply thrown into a basin of ordinary water. The hands of the surgeon were as clean as a gentleman would always keep his hands. The amputation having been done, the arteries were tied with silk threads (called "ligatures"), one end of each being left long. These ends were left hanging out of the wound at any convenient place, and in an amputation of a muscular thigh might number a score or more. Hæmorrhage having been checked, the two flaps were sewed together with wire or silk threads, called "sutures." In threading the needle, the thread would often be shaped into a point by the lips, or, after being wetted with septic saliva, would be rolled between septic fingers. A piece of lint, or often a piece of soft, old linen "rag," spread with some grease, was placed upon the stump, and a suitable bandage applied. The next day the dressings were removed, and the wound was redressed in a similar manner. At the end of twenty-four or forty-eight hours a fever would set in, called in our text-books "surgical fever," thus assuming that a surgical operation always resulted in such a fever; nor was the assumption erroneous. This would continue for several days, the temperature ranging from 102° to 104° or 105° F. In a few days, when suppuration became established (and this was always expected by the surgeon), the fever would gradually subside, and later the suppuration also would diminish. At the end of a week or ten days the surgeon would pull gently on each silk ligature, to see if it had rotted loose from the blood-vessel and could be removed. If the wound became unduly inflamed, poultices would be applied; and finally, after three or four weeks, the ligatures would all have been removed, and the wound would soon be healed. Very rarely, indeed, would a wound heal without suppuration. If it did, it always excited remark, and would be recounted as a surgical triumph. Often, on the other hand, grave complications arose by the formation of abscesses; erysipelas and gangrene were fertile sources of danger, and very often of death; while secondary hæmorrhage —that is, hæmorrhage following premature rotting of the ligatures on the blood-vessels—was always a possible and frequently an actual and formidable danger to life. A serious operation from which the patient recovered in less than a month was a "remarkable case."

Contrast this with a similar operation performed to-day by any ordinarily well-instructed surgeon. The day beforehand, the skin in a wide area around the site of the proposed operation will first be scrubbed by a nail-brush with soap and water, then with ether, then with some antiseptic solution, most frequently at the present day a solution of corrosive sublimate, one part to one thousand of water, and then covered with an antiseptic dressing until the operation is begun. The object of this is to free the skin from dirt and fatty matter, making it *surgically* clean and free from germs. The instruments will have been boiled in a covered vessel for fifteen minutes, or disinfected by carbolic acid or some equivalent germicide, and are then placed in a tray filled with an antiseptic solution. In the cleaning of them after the last operation all rough and more or less inaccessible places where germs may accumulate (especially, for instance, the joints) will have been scrupulously disinfected. If during the operation an instrument is laid down, it is never placed on the clothing of the patient, but either is replaced in the tray, or laid upon towels or sheets which have been disinfected and spread all over the patient's person and clothing all around the field of operation.

After an operation the sponges are thrown away if they have become infected from pus; but, if not, they are very carefully disinfected, and then kept permanently in a carbolic solution. At the next operation they are placed in a tray containing some antiseptic, or at least water which has been boiled, for heat has been found to be one of the best antiseptics. If a sponge or an instrument fall on the floor, it is laid aside, or before being used again is thoroughly disinfected. The hands of the surgeon will next receive especial care. First they are scrubbed with soap and water and a nail-brush. Then the nails are cleaned anew, for the dirt which accumulates under them is found to be one of the most fruitful sources of infection. Then the hands are washed in pure alcohol, and last, while wet, are again scrubbed with the antiseptic solution, the nails again receiving great care. If during the operation the hands touch anything not itself already disinfected, they must again be disinfected.

These precautions being complete, the operation is begun. The blood-vessels are tied with catgut or silk which has been disinfected, and *both* ends are cut *short*. These ligatures are not irritating like the non-disinfected silk formerly used. As no end hangs out, they are never pulled upon, but are slowly absorbed, and nothing is ever heard of them again. In consequence of this the blood-vessels are never afterward disturbed, and secondary hæmorrhage is now one of the rarest complications following an operation. A disinfected rubber tube, with holes in it for draining away the wound fluids, which ooze from the raw surfaces for some time, is then inserted between the flaps, with a bundle of horse-hairs alongside of it. The flaps are now united by sutures of catgut, disinfected as before, or sutures of wire or of silk similarly prepared. A large, soft dressing of many layers of dry cheese-cloth is next applied by a bandage. This dressing has been thoroughly impregnated with corrosive sublimate or some other antiseptic solution. The finest linen or lint, clean as the driven snow to the ordinary eye, is dirty to the eye of an antiseptic surgeon, since it is not cleansed from the microscopical germs that will surely cause infection. At the end of twenty-four hours the drainage tube is removed, the horse-hairs being sufficient for the slight later drainage, and another similar dressing of dry antiseptic cheese-cloth is applied. The horse-hairs are entirely removed after four or five days.

The temperature of the patient scarcely rises above the normal. Apart from the discomfort of the ether-vomiting, from shock, and from loss of blood (from all of which the patient generally recovers in twenty-four hours or less), he will suffer but little pain. It is not an infrequent thing to see a patient recover, even from a severe operation, without having suffered much pain. By the fifth or the tenth day, when the second dressing will be applied, the wound is well. No complications ought to occur, saving in exceptional cases. Secondary hæmorrhage is unknown. Primary union of the flaps is now always expected. The formation of pus is a rare accident; if it does occur, the surgeon asks himself, "What mistake did I make?"

Let us now see what the results have been in amputations. In Professor Billroth's clinic in Vienna, in the seventeen years from 1860 to 1877, there were 315 major amputations done (i. e., excluding fingers and toes) in the most approved methods of the days before antiseptics were introduced. Of these, 173, or 54 per cent., died. From 1877 to 1880, 91 such amputations were done by the same surgeon with antiseptic precautions, and the mortality fell to 18, that is, 19.7 per cent. Of the 91 cases, 56 were uncomplicated cases, of whom not one died. The general rates of mortality in amputations in different hospitals in the days before antiseptics were employed have ranged from 23 to over 53 per cent. Since the introduction of antiseptics some idea of the saving of life, to say nothing of the immense decrease of pain and suffering, may be gathered from the following additional figures: In von Bruns' clinic, 47 major amputations were done antiseptically, and not one died. Busch reports 57 similar amputations, with a mortality of 3.5 per cent.; Schede 31 amputations with a mortality of 4.37 per cent.; Socin, 48 amputations, and a mortality of zero; and Volkmann, 220 amputations, with a mortality of but 3.5 per cent. I have purposely quoted the statistics of six operators so as to show that it is not the man, but the method, which has yielded such splendid results.

This perfection has been reached by an immense deal of labor on the part of many observers, first and foremost, *primus inter pares*, Sir Joseph Lister, now of London. The experiments have been made chiefly in two directions. First, on animals, to discover what was the best method of treating wounds, and especially to select the best material for ligatures and sutures by which to tie the bleeding vessels and unite the flaps, the object being to obtain that material which would not carry infection, and which, at an early date, would be entirely absorbed. These experiments upon animals have been attended with but little pain, and in many cases practically none, for they, too, have been done antiseptically. The results shown above attest the immense value of the investigations. Yet the antivivisection laws in England are so hostile to all humane progress in surgery that when, a few years since, Sir Joseph Lister desired to carry on some experiments with a view to still greater perfection, he was obliged to leave London and go to France in order to perform them. After experimenting in animals with ligatures, with sutures, and with disinfectants in the various modes of the antiseptic treatment of wounds, then followed the crucial test in man—a test only justified by the good results first obtained in animals. These trials have from time to time been followed by modifications in detail, but practically none in principle.

Secondly, this result has been attained by a painstaking study of the entire life-history of the many varieties of microbes or bacteria now known to exist; what distinguishes one from another, and what favors and what hinders the development of each. Next the effects of their intentional inoculation in animals were observed; and then the results of their occurrence in man in various diseases and accidents. In fact, this study of bacteria is now a distinct science, known as bacteriology, and has among its students some of the most noted names in medicine. One of the practical results of such scientific study of bacteriology is seen in the recent immense improvement of our treatment of that dangerous accident already alluded to—compound fractures. The statistics of compound fractures from a half-dozen of the best hospitals of America and Europe for varying periods from twelve to twenty years before the introduction of antiseptic methods gave a mortality varying from 26 to 68 per cent., the majority of deaths being from serious complications due to blood-poisoning. The introduction of antiseptics caused a falling off of the death-rate of Billroth's cases in Vienna to *one-tenth* of what it formerly was, and in the other hospitals in similar though varying proportions. Still more remarkable are the results recently reported by Dennis of New York. Of 446 compound fractures of all grades, from the most severe down, of which 385 belonged to the class of severe fractures, only 2 died, the mortality being less than *one-half of one per cent.*—less than 2 in 400 in contrast to the rate previous to the introduction of modern surgical methods of from 104 up to 272 in 400! At present his list of cases extends to about 900 without a single death from blood-poisoning. Nothing can add force to such a statement.

Besides these very remarkable results in the almost certain and painless healing of severe accidents and of operation wounds within the last few years, as a result of the scientific studies just noted, many other achievements have been made possible by them in modern surgery, to which I must now allude.

The two regions of the body in which the most marvelous advance has been made are the abdomen and the head. Twenty-five years ago, to open the cavity of the abdomen and explore the peritoneum (a thin membrane which lines the entire cavity and covers all its contents) was a step from which every prudent surgeon shrunk. If it were opened by accident, there was nothing left for us but to do the best we could, and usually the best meant, in the absence of antiseptic methods, to look on until the patient died, helpless to do aught except administer a few anodynes until death came to his relief.

During the war of the rebellion there were 64 cases of wounds of the stomach, and only 1 recovered. Otis estimated the mortality at 99 per cent. In over 650 cases of wounds of the intestines there are recorded in the literature of the war only 5 cases of recovery from wounds of the small intestine (and there is some doubt as to whether the intestine was wounded in these 5) and 59 from wounds of the large intestine. A gun-shot wound in the abdomen was looked upon as almost necessarily fatal. Surgeons did not dare to open the abdomen either to search for the ball, to close a fatal perforation of the bowels, or to check hæmorrhage.

America can rightly boast of playing the chief rôle in effecting the change that has taken place. The elder Gross long since led the way by his experiments on dogs, but we owe our present boldness and success chiefly to the experiments of Parkes, Bull, and Senn,—all Americans,—who have first shown in animals that it was safe and right, with antiseptic methods, to interfere actively for the health and healing of our patients. While it is true that a small rear-guard in the surgical army would fold their hands and give opium until the patient died, there is scarcely a man abreast with modern ideas who in such a case would not open the abdomen, tie bleeding vessels, sew up a rupture or wound of the stomach or bowels, remove a lacerated kidney, and in general repair any damage done. Of course, large numbers of such patients, either from immediate hæmorrhage, or from the severity of the wound inflicted, must always die. But, to say nothing of the numerous other cases in which recovery has followed operative interference in such wounds, even though multiple, the possibilities of modern surgery are well shown in a case reported by Senn, in which eleven perforations of the bowel were sewed up, and another case of Hamilton's in which there was so extraordinary a number as thirteen wounds of the intestines, besides wounds of the omentum and the mesentery, and yet both of these patients made uninterrupted recoveries! In a recent table by Morton of 19 cases of stab wounds (all, of course, by dirty knives, and one even by a ragged splinter of dirty wood) with hæmorrhage and protrusion of the bowels, 12 recovered and but 7 died, and even of 110 gunshot wounds of the intestines in which the abdomen was opened, 36 lives were saved.

If this be the admirable showing in wounds attended by infection from dirty knives, from the dirt on the clothing, and from the ground on which wounded persons would fall, it is no wonder that, with clean hands and instruments, surgeons have dared not only to open the abdominal cavity to verify a probable diagnosis, or to perform an operation, but to go still farther and to open the abdomen to *make* a diagnosis. It is often impossible to make an absolute diagnosis from external examination alone, not only on account of the inherent difficulty from the close grouping of so many organs within the abdominal cavity, but even in cases apparently not obscure we may be in error. At the present day it is not only considered justifiable and not unreasonably dangerous to open the abdomen for the removal of tumors that are clearly fit for operation, but in a very large number of doubtful cases it is the *duty* of the surgeon to make a small opening directly into the abdominal cavity, and to insert two fingers in order to determine by touch what the nature of the tumor or other disorder is, and, having determined its nature, to proceed to its removal, if the facts warrant it; if not, the abdominal wound is closed, and the patient almost always recovers from the incision. So slight is the danger from such "exploratory operations," as they are rightly called, that it is not to be weighed for a moment against the advantages derived from positive knowledge.

The most remarkable statistics recently published are those of Mr. Tait, and a mere statement of his percentages will go far to convince the non-medical public of the correctness of the above statements, startling as they appear to one unfamiliar with modern surgical progress. Mr. Tait has completed a second series of 1000 cases in which he opened the abdomen for the removal of tumors, for abscesses, for exploration, etc. In his first 1000 cases only 92 patients died (9.2 per cent.), and in the second 1000 only 53 died (5.3 per cent.). In ovariotomy alone the percentage fell from 8.1 in the first 1000 to 3.3 in the second. Only a quarter of a century ago the mortality of ovariotomy was but little, if at all, under 50 per cent. I have heard the first obstetrician of his day, when I was a student, say that any man who dared to open the abdomen to remove an ovarian tumor should be indicted for murder! Sir Spencer Wells, even with the far larger mortality of his earlier days, added 20,000 years to human life as the net result of 1000 ovariotomies! He has lived to see even his great success far surpassed by the best surgeons; and all over the civilized world, even the average surgeon is followed by benedictions for recovery in ninety out of every hundred of such operations.

Surgeons have even successfully removed tumors that after removal weighed more than all the rest of the patient's body. But we go further than the mere removal of abdominal tumors. In a considerable number of cases of cancer of the stomach the diseased part of the stomach itself has been removed, and the patient has made a good recovery. Of course, however, the disease often returns, and is eventually fatal. In cases of cancer and obstruction of the bowels, or of extensive wounds, even three or four feet of the bowel have been completely removed, the ends sewed together, and the patients have recovered. In other cases, instead of removing the diseased parts, openings have been made in the bowel, one above and one below the disease, the two openings being then placed opposite each other and united by their margins, and the continuity of the bowel has been thus successfully re-established, the intestinal contents following the "short-cut" thus provided. This very new operation has only been done in man in a very small number of cases, but the mortality in dogs is only 7.69 per cent., and as our procedure will improve by experience, it will probably be even less in the human subject.

When the spleen is enlarged, it also has been successfully removed in 90 cases, followed by 51 recoveries. Occasionally the spleen, instead of being fixed in its place, is loose or "floating" in the abdominal cavity. In 10 cases these have been removed, with 8 recoveries.

Another remarkable achievement of abdominal surgery is in operations on the gall-bladder. Occasionally a number of gall-stones* are formed in the gall-bladder or its duct and produce dangerous and often fatal disease. In 78 cases now recorded the gall-bladder has been opened, the gall-stones removed, and 64 of the patients have recovered. Not satisfied even with this, in 22 cases the entire gall-bladder itself has been removed to prevent any recurrence of the disease, and 19 of the patients have demonstrated the fact that they could get along quite as well without such an apparently useless appendage as with it; in fact, in their cases at least, a good deal better. In 100 operations, therefore, on the gall-bladder the mortality has only been 17 per cent. Mr. Tait himself has performed 54 such operations, and has lost but 2 patients, a mortality of less than 4 per cent. Considerable portions of the liver have also been removed with success, one of the operations being necessitated as a direct result of the use of corsets, in the opinion of the operator.

* These stones arise from the bile, and are often as large as marbles. Sometimes only one exists, but sometimes there are even hundreds of them.

Operations on the kidney are among the most remarkable triumphs of abdominal surgery. In 1869 Simon, of Heidelberg, had a patient suffering from various troubles with the duct of the kidney. After many experiments on dogs to determine whether it was possible for them to live with one kidney, after the sudden removal of its fellow, he ventured to remove this otherwise healthy organ, and the patient lived for eight years in perfect health. Since then very many such operations have been done, and the latest results are as follows: In 375 cases of entire removal of one kidney in consequence of its being hopelessly diseased, 197 lives were saved. In 95 cases of abscesses and other diseases, in which the kidney was cut down upon in the loin or abdomen, and the kidney opened and drained, 76 lives were saved. In 102 cases in which stones were removed from the kidney, 76 lives were saved, and in 25 cases in which the kidney (as in the case of the spleen above referred to) was "floating" around loose in the abdomen, and a source of discomfort and pain, it had been cut down upon, sewed fast in its proper place, and all but one got well, and even this one death was from injudicious surgery. A total of 597 operations on the kidney shows, therefore, recovery and in general complete restoration to health in 373. Had the patients been let alone (as they would have been prior to Simon's experiments in 1869), *almost every one would have died,* and that too after weeks, or years it might be, of horrible pain and loathsome disease.

But the most extraordinary achievement of modern surgery remains to be told. In the "Lancet" for December 20, 1884, Dr. Bennett and Mr. Godlee published an article which startled the surgical world. Dr. Bennett had diagnosticated not only the existence, but the exact locality of a tumor in the brain, of which not the least visible evidence existed on the exterior of the skull, and asked Mr. Godlee to attempt its removal. The head was opened and the brain exposed.

No tumor was seen, but so certain were they of the diagnosis that Mr. Godlee boldly cut open the healthy brain and discovered a tumor the size of a walnut and removed it. After doing well for three weeks, inflammation set in, and the patient died on the twenty-sixth day. But, like the failure of the first Atlantic cable, it pointed the way to success, and now there have been 20 tumors removed from the brain, of which 17 have been removed from the cerebrum with 13 recoveries, and 3 from the more dangerous region of the cerebellum, all of which proved fatal. Until this recent innovation *every* case of tumor of the brain was absolutely hopeless. The size of the tumors successfully removed has added to the astonishment with which surgeons view the fact of their ability to remove them at all. Tumors measuring as much as three and four inches in diameter and weighing from a quarter to over a third of a pound have been removed and the patients have recovered.

Another disease formerly almost invariably fatal is abscess of the brain. In the majority of cases this comes as a result of long-standing disease of the ear, which after a while, involves the bone and finally the brain. So long ago as 1879 Dr. Macewen, of Glasgow, diagnosticated an abscess in the brain, and wished to operate upon it. The parents declined the operation, and the patient died. After death Macewen operated precisely as he would have done during life, found the abscess and evacuated the pus, thus showing how he could probably have saved the child's life. Since then the cases treated in such a manner amount to scores, and more than half of them have recovered without a bad symptom.

In injuries of the skull involving the brain, the larger arteries are sometimes wounded, and the blood that is poured out between the skull and the brain produces such pressure as to be speedily fatal. In some cases, even without any wound, the larger arteries are ruptured by a blow or fall, and a similar result follows the hæmorrhage. Nowadays, in both of these injuries, any well-instructed surgeon will open the head, secure the bleeding vessel, and turn out the clot with a good chance of recovery in a large number of cases. Even gunshot wounds of the brain are no longer necessarily fatal. Among a number of other successful cases one has been recently reported in which the ball went all the way from the forehead to the back of the head, and after striking the bone rebounded into the brain. The back of the skull was opened, the ball removed, and a rubber drainage tube of the calibre of a leadpencil passed in the track of the ball completely through the head, and the patient recovered. So little danger now attaches to opening the skull, with antiseptic precautions similar to those already described, that the latest writer on trephining (Seydel) estimates that trephining *per se* is fatal only in 1.6 per cent. of the cases. Mr. Horsley has recently published a most remarkable paper, including 10 operations on the brain, in which, without anything on the exterior to indicate its situation, the site of the disease was correctly located in all, and 9 of them recovered after operation.

Almost equally astonishing are the results of brain surgery in certain cases of epilepsy; for the surgical treatment of the cases justifying such interference has been attended with the most brilliant results. In these cases the spasm begins in a particular part of the body; for example, the hand or the thumb, or it is limited to one arm, or to one side of the body. Some of them have been operated upon without any benefit, but a large number of other cases have been operated on and either benefited or, in not a few cases, have been completely restored to health. That the words "brilliant results" are not inappropriate will certainly be granted when we look at Mr. Horsley's table of cases. One patient had 2870 epileptic convulsions in thirteen days, and completely recovered, not only from the operation, but also from his terrible malady, after the removal of a diseased portion of the brain, the result of an old depressed fracture of the skull. Besides this, a few cases of headache so inveterate as to make ordinary occupations impossible and life itself a burden have been cured by trephining the skull. Even insanity itself has been cured by such an operation in cases in which it has followed injuries to the head. What the ultimate result of these recently inaugurated operations will be it is impossible to tell as yet, but thus far they have been so beneficent and so wonderful as to arouse not only our greatest astonishment, but also our most sanguine hopes.

The question will naturally arise how is it that the neurologists can determine so exactly the location of such tumors, abscesses, hæmorrhages, scars, and other alterations of tissue giving rise to epilepsy and other disorders mentioned, without the slightest indication on the exterior of the skull to point to the diseased spot. That this is of supreme importance in the brain will be evident upon a moment's reflection. In other parts of the body, even if we make an error of an inch or two, it is of comparatively little importance, as the incision can be easily prolonged, and heals readily. But in the skull, from the very nature of the bony envelope, an error of an inch or two means almost certain failure to find the disease, and means, therefore, possibly the death of the patient.

It is impossible within the limit of this paper to state in detail the method, but the following brief sketch may give some idea of it. Whatever can be advanced against vivisection, there is this to be said in its favor, that without it the exact localization of cerebral tumors and other such lesions, which is one of the chief glories of the present day, would be impossible. We owe our knowledge of the location of cerebral functions to many observers, chief of whom are Ferrier and Horsley, of England, and Fritsch, Hitzig, and Goltz, of Germany. Horsley's method will suffice as a type.

The brain of a monkey having been exposed at the part to be investigated, the poles of a battery are applied over squares one-twelfth of an inch in diameter, and all the various movements which occur (if any) are minutely studied. One square having been studied, the next is stimulated, and the results are again noted, and so on from square to square. These movements are then tabulated. For example, all those adjacent squares which, when stimulated, produce movements of the thumb are called the region for representation of the thumb, or, shortly, "the thumb centre"; and to all those squares which produce movements of the hand, the elbow, the shoulder, or the face, etc., are given corresponding names. In this way the brain has been mapped out, region by region, and the same minute, patient study given to each.

These animals, I should add, are etherized so that they do not suffer the least pain. I may also say in passing that such operations, with few exceptions, even without ether, are not painful. The brain itself can be handled, compressed cut, or torn without the least pain. A number of cases have already been reported in which a considerable portion of the human brain has been removed by operation and the patients have been out on the street within a week, without pain, fever, or a single dose of medicine.

Studying in this way the brain of the lower animals, we now have a very fair knowledge of the localization of many of its functions. With the functions of the front part we are as yet not familiar. The part which lies, roughly speaking, behind and in front of one of the chief fissures of the brain (the fissure of Rolando), which runs downward and forward above the ear, is known as the motor region." In this region the different centres have been mapped out in the monkey's brain, and have been verified in the brain of man many times. Most of that part of the brain above and behind the ear has no special functions that we know of at present, except one region, which is the centre for sight. Injury to this produces blindness of the half of each retina on the same side as the injury to the brain. But it is extremely difficult to obtain in the lower animals any evidence of the special senses other than that of touch, the abolition of which produces loss of feeling, of which we can get exact evidence. Motion and sensation, therefore, are the two things that can be most readily determined.

Having now ascertained in animals the location of the particular centres, the next step is to apply this knowledge to the human brain in judging of the processes of disease. But it will be easily seen that the experiments that disease performs in a human brain are clumsy, spread over a wide area, and therefore often difficult of interpretation. Instances affecting a single little area of brain surface one-twelfth of an inch in diameter are almost unknown, and a tumor has been removed of such size that it produced direct pressure upon more than *twelve hundred* such squares, and indirectly produced pressure upon many distant parts of the brain. This is, of course, very clumsy experimentation. The familiar game of "shouting proverbs" will well illustrate the difficulty of interpreting the answers of disease to our question, "Where is it located?" Imagine 1200 persons, each assigned a single word of a proverb of 1200 words. At a given signal each shouts his own word. What a Babel of sound! How utterly impossible of disentanglement and proper arrangement! This is the answer of disease as represented by such a tumor. Take each of the 1200 persons in the proper order and question him separately and repeatedly, write down the answers accurately and in their proper sequence, and behold the proverb! This is the answer of scientific investigation as seen in vivisection.

Instead of there being a tumor, a blood-vessel will sometimes break in the brain, and produce a clot, affecting similarly a large area; or softening of the brain will in the same way invade an equal or a greater number of centres. It is therefore extremely rare that we can find a small area, such as that for speech, or for the hand, or for the arm, or for the face, or for the leg, or for sight, that is involved entirely by itself. But such cases do occasionally occur, and they are extremely valuable in fortifying the conclusions derived from the exact experiments of the laboratory. While some of the cases have introduced confusion and uncertainty from the character of nature's experiments, it can be broadly asserted that generally they have absolutely confirmed them. The results obtained by the surgery of the brain have more than confirmed them; for, as indicated already, the brain has been opened, and that portion which, according to experiment, is believed to be the centre for the wrist, or for the shoulder, etc., has been cut out, and paralysis of the corresponding part (a paralysis which, however, is only temporary) has proved positively the exactness of the inference from animals.

We are still a little uncertain as to the exact functions of large portions of the brain, but we have made a reasonable beginning; we have found firm ground to stand upon, and the results already obtained in the relief of human suffering and the cure of disease are such as readily encourage the hope that in the near future we shall be able to do vastly more. The opponents of vivisection have stoutly contended that it has shown no useful results. Let us wholly ignore the researches of Sir Charles Bell, of Harvey or Hunter, or other experimenters of the past. Here is a field in which the last ten years have opened wholly new ground for modern surgery, in which already the operations of the last four years have been marvellously successful, and have startled even surgeons themselves. Had vivisection done nothing else than this, it would be amply justified, and to obstruct researches so rich in beneficent results would be a disaster to humanity.*

But not only has the brain been opened and compelled to give up its secrets, and to yield itself to the successful assaults of the surgeon, but the spine has also of late been the field of some remarkable work. About a year ago Mr. Horsley reported a remarkable case, in which a tumor by pressure on the spinal cord had been the source of most frightful pain for a long time, and of paralysis of all the lower half of the body. Once that an accurate diagnosis, not only of its existence, but of its actual locality, was made, he made an incision in the back, exposing the backbone, cut away the bone down to the membrane, and even to the spinal marrow itself, and removed the tumor. When last reported the patient was able to walk three miles, and even to dance. Since then there have been numerous successful operations upon the spine in this country, in England, and in France, and the near future will doubtless show even better results. Already severe fractures of the spine have been operated upon by removal of the fragments sticking into the spinal marrow, and recovery has followed instead of a lingering and certain death.

We are only just beginning to interfere surgically with the lungs; to open abscesses in them, and to remove por-

* The facts stated in this paper, it seems to me, are a striking vindication of the value and necessity of vivisection. Personally I have never done any such experiments, save a few some twenty years ago. Indiscriminate experimentation by untrained students I would heartily discourage, as they would lead to no good results. But as a matter of fact such indiscriminate experiments by students do not exist. They have neither the time, the money, nor the facilities for it. Only competently trained men who will make a serious and systematic investigation of definite problems, and educe the knowledge that will widen our scientific horizon and enlarge our resources in the healing art, should engage in it, and as a fact I believe only such do engage in it. Moreover, they ought to, and, so far as my knowledge extends, they do inflict no needless pain.

tions successfully; and several ribs have been removed in cases of chronic pleurisy and deformed chests.

Formerly one of the most dangerous operations known was the removal of goitres. Hæmorrhage, inflammation, and blood-poisoning destroyed a very large number of such cases, and when Kocher, of Berne, in 1882, reported 58 operations, with a mortality of only 14.3 per cent., it was deemed a triumph. But improved methods of operation reduced the mortality until, in 1884, he reported 43 more operations, with a mortality of only 6.9 per cent., and in 1889 he has just reported 250 additional operations, and all but 6 patients recovered—a mortality of but 2.4 per cent., or, if we exclude the 25 cases of cancer, which gave 4 of the deaths, we have 225 cases and only 2 deaths, a mortality of but 0.8 per cent.

We see few cases of severe knock-knee and bowlegs in this country, but among the ill-fed lower classes of Europe they are common. Formerly almost nothing could be done; but a few years ago surgeons began to operate upon them in this way: A small cut is made through the skin and muscles down to the bone, and by a saw or a chisel the bone is divided. The limb is then straightened, and the case treated precisely as if it were an ordinary fracture. It heals without fever or serious pain, and the patient is well. With modern methods this is not a dangerous operation, as will be seen by the remarkable paper read by Macewen, of Glasgow, at the International Medical Congress of 1884, in Copenhagen, when he reported 1800 operations on 1267 limbs in 704 patients, and only 5 died, in spite of the fact, too, that most of them, from deformity in several limbs, had to have multiple operations. Even these deaths were not due to the operation, but followed from pneumonia, typhoid fever, consumption, and diphtheria.

We have learned, too, that portions of the body can be entirely severed, and, if suitably preserved, can be replaced, and they will adhere and grow as if nothing had happened. When a wound is slow in healing, we now take bits of skin, either from the patient's own body or provided by generous friends, or even from frogs, and "graft" them on the surface of the wound. They usually adhere, and as they enlarge at their margins, they abridge by one-half the time required for healing. Even a large disk of bone, one or two inches in diameter, when removed from the skull, can be so treated. It is placed in a cup filled with a warm, antiseptic solution. This cup is placed in a basin of warm water, and it is the duty of one assistant to see that the thermometer in this basin shall always mark 100° to 105° F. The bone may be separated from the skull so long as one or two hours, but, if properly cared for, can be replaced, and will grow fast and fulfill its accustomed, but interrupted, duty of protecting the brain.

The remarkable progress of surgery which I have so imperfectly sketched above has been, as I have shown, the result chiefly of experimental laboratory work. To Mr. Carnegie, of New York, is due the credit of establishing the first bacteriological laboratory in this country, and from studies in this laboratory arose the brilliant and beneficent results in the treatment of compound fractures which I have quoted. If one laboratory can give such beneficent results in one single surgical accident, what will not many do, each vying with all the rest in investigating different important surgical and medical questions as yet unsolved? Could wealthy private citizens erect more useful monuments of enduring fame? In Europe the government establishes and supports such laboratories. In America we must look to private munificence, and never yet has humanity made such an appeal to my countrymen in vain.

THE NEW ERA IN MEDICINE AND ITS DEMANDS UPON THE PROFESSION AND THE COLLEGE.*

ON the 8th of October, thirty years ago, I entered the lower lecture-room of the College building for the first time as a medical student, and listened to the Introductory Lecture. It was given by that phenomenal encyclopædia of knowledge, Robley Dunglison, for so many years the Dean and Professor of Physiology in this School. Time has gradually obliterated its then deep impressions, and now three memories alone remain to me. The first is the place where I sat; the second the precept, which has so often since then recurred to my mind in solving the medical problems which have presented themselves to me, that I must not confound the *post hoc* and the *propter hoc*, the sequence with the consequence; and the third was the gracious welcome which that fluent master of English gave to us, the incoming class.

It is my pleasant duty to-night to repeat, after a lapse of so many years, at least the same cordial welcome then extended to me—a welcome to you all, from North and from South, from the Atlantic and the Pacific, and even from far-distant foreign shores. Nor is this welcome a merely formal one; it is heartfelt and true. Not only for myself, but on behalf of my colleagues of the Faculty, do I welcome you, as kindly and as earnestly as I possibly can, to the

* Introductory Address at the opening of the Sixty-sixth Annual Session of the Jefferson Medical College. Reprinted from the Times and Register, October 18, 1890.

arduous study upon which some of you are about to enter; a welcome, quite as cordial, I also extend to those who have already trodden the thorny path of the first or second year of study, and who have now a better capacity to appreciate what they learn, and a better appreciation of the earnest efforts that will be made by every teacher of the school from the oldest of the Faculty to the latest acquisition among the assistants in the laboratories.

The welcome thus extended is saddened, however, by mournful memories. It is with feelings of deep respect and admiration that I refer, as is proper, to the teacher whose honored place I occupy, whose premature and unexpected death robbed the Jefferson College of one of its brightest ornaments; a man illustrious by his name, and not less honored for his own eminently useful scientific achievements. The warmth of admiration and affection which the older students among you bestowed upon the late Samuel W. Gross was not ill bestowed, but was well deserved. Professionally he knew but one thing—Surgery. Even from his very entrance on his profession, this was his chosen department, and to it he devoted laborious days and studious nights. As a teacher he was incisive, progressive, well read, versatile, and accomplished. He was no uncertain and hesitating teacher, but gave you, in his own clear-cut and positive way, the best results of the foremost minds of the profession, both of this country and of Europe. Many of you can testify to his devotion to his subject, his students, and his Alma Mater. He sympathized with your joys, and helped you over the rough places with the utmost gladness. Few schools have had two such ornaments in one family as the elder and the younger Gross; and in the midst of all the pleasure and hilarity of the opening of the session, it is meet and proper that we should pause a moment to lay a flower on the bier of each.

A moment ago I referred to the time when I myself began the study of medicine. You can scarcely appreciate what the study of medicine then meant, as compared with what it means to-day. About the time that I began, the custom had just ceased for each member of the Faculty to deliver an Introductory Lecture to his course each year. The session began on the second Monday in October, and the entire first week was given up by the Faculty to the daily Introductories, and by the students to more or less of revelry, as might become both their consciences and their purses. In the next week we settled down to greater or less regularity of life. The session continued until the end of February, and not a few men of the first year, like Charles Lamb, made up for coming late by going early. Examination over, the iron gate that used to guard the Tenth Street entrance to the College swung heavily to, and was not opened again until the next October.

There were no laboratories. Apart from the seven classical branches there was absolutely no official instruction. No man was required to study physical diagnosis, or minor surgery, or chemistry, or the microscope, either in histology or morbid anatomy; and perhaps not a score of men in any graduating class had ever seen a muscular-fibre cell, or striped muscular tissue, or a nerve-cell, or a nerve-tubule. The fortunate few who, in the offices of private preceptors, had a chance to give a wondering look from time to time through a microscope; to examine the urine for tube-casts, or for any crystalline element, were equally small in number. Nor were there more who were ever taught to test the urine for albumin. The only histological reagents were acetic acid for clearing up a specimen, and carmine to color it, and the hand-held razor was the only microtome. There was no laboratory of physiology, no teaching of pathological anatomy, no instruction in pharmacy. Nor could any man properly write his first prescription, unless he had been privately taught by his quiz master or his preceptor. The only clinical instruction was in medicine and surgery, neither obstetrics, gynæcology, nor any of the specialties being recognized. Indeed, a specialist was looked at askance as a very questionable sort of doctor.

The seven months intervening between February and October were presumably spent with one's preceptor at home. How much each student would learn in that time I leave you to judge as leniently as possible. During the spring and fall, however, there were open a few private lectures from voluntary associations of teachers, some of whom, now occupying honored places, I see about me. But these advantages were limited almost exclusively to the students who lived in the city. The examinations were easy, and for the disabled students an "omnibus" was prepared to carry them to, if not through, the perils of the "Green room."

Contrast this with the opportunities that you have to-day. Every student has now the opportunity to become versed in bandaging, the application of fracture dressings, and the performance of all the ordinary surgical operations on the cadaver. All of you will have had some practice and careful clinical instruction in physical diagnosis. All of you will have attended lectures on pathology and have made a more or less careful personal study of both normal and diseased structures with the microscope. All of you will have passed through the laboratories of physiology, of materia medica, of experimental therapeutics, of pharmacy, of chemistry, and have studied especially the chemistry of the urine and other secretions and excretions of the body. All of you will have had careful instruction in practical obstetrics, in obstetrical examinations, and in gynæcological operations. All of you will also have had instruction in diseases of the eye, the ear, the throat, the nose, in electricity, toxicology, orthopædics, diseases of the skin, diseases of children, and insanity, not one of which was officially taught in this or in any other medical college when I was a student.

This immense change smacks almost of revolution. But there is need of a new and fresh overturning. The last few years have seen such rapid movement and progress in every department of medicine that we stand practically in a "New Era in Medicine," and the new era makes new demands both upon medical colleges and the medical profession to which, if we be blind, we shall be derelict in our duty, both to ourselves and the public.

Let us for a moment take a bird's eye view of these changes. First of all, a wholly new department of medical science—Bacteriology—has been created. Rejected at first by most, and only doubtfully and hesitatingly believed in by many, except some prophets of the dawn endowed with finer vision than the rest, it has achieved within the last ten years a positive and now practically unquestioned place in medical science. Its revelation of the causes of many diseases and its explanation of their phenomena are as startling as they are well substantiated. That suppuration and erysipelas, tetanus and leprosy, consumption and cholera are parasitic diseases due to the invasion of the body by various forms of micro-organisms is a discovery of the first importance, and much too near for us to appreciate as yet its far-reaching influence. Bacteriology has but begun its infant career. It must speedily grow into one of the most weighty of the scientific departments of medicine, and bids fair to revolutionize our practice as much as it has our theories.

The old Materia Medica and Therapeutics have been re-written within the last few years in the Pharmacology of the present day. The actual daily use of medicine has been marvelously changed of late by experiments made to discover the real physiological and therapeutical action of remedies; their effects upon the heart, the arteries, the brain, the respiration, the kidneys; their medicinal and their toxic doses and effects; and from these facts to deduce a right and rational use of drugs. Besides this the extraordinary number of new drugs and the numberless new methods of their administration, the present scientific use of massage and of electricity in its various forms, the increasing use of Swedish movements, of heat, of cold, of mechanical means for soothing and stimulating nerves and muscles, and for spinal extension are all additions of the last few years.

Allied to this there is virtually a "New Chemistry," not only in the sense in which the term is used by Professor Cook. Organic chemistry, by its analytical methods, has given us many of the new drugs already alluded to, and by its synthetical combinations has even produced them in the laboratory instead of waiting for Nature's slow distillation or long growth; and, by its substitution compounds, has given us different series of remedies of immense value, all built upon a single base.*

Chemistry and pharmacology, with physiological physics, embryology, and experimental physiology, have developed a new Physiology.

Even Anatomy, a field of stubble scarce worth a gleaner's searching eye as was supposed by many, has rewarded the industrious toiler by rich and full sheaves. Even in gross anatomy, to name no other, the mapping of the convolutions of the brain, and determining their functions, by Ferrier, Horsley, and others; the study of surface anatomy in its relations to the interior, by Holden; the careful study of the intestinal canal by Treves, have been of immense service: while embryology and histology and comparative anatomy have reformed a large part of the science.

These scientific departments are the foundation upon which are built surgery, medicine, obstetrics, and gynæcology, the practical departments of the healing art. These, too, like Samson of old, have burst the withs and ropes of the past

* If any one doubt the existence of a new-visaged and promising chemistry and pharmacology, let him only read the recent lectures of Dr. Lauder Brunton, in the British Medical Journal, On the Relation between Chemical Composition and Physiological Action.

and risen up in renewed strength, and have gone forth conquering and to conquer.

In Surgery and Gynæcology the effects of experiments upon animals, of bacteriological studies, and of the antiseptic method, have been almost past belief. The mortality of amputations has been reduced from twenty-five to fifty per cent. down to from four per cent. to zero, and compound fractures, instead of yielding a holocaust of fifty to sixty per cent., are now, if rightly treated, scarcely more dangerous than simple fractures. The abdomen, instead of being forbidden ground like the lost Eden, with the peritoneum for its "flaming sword which turned every way to keep the way of the tree of life," might almost be called a playground in which surgeons disport themselves to their heart's content, inventing new operations as children invent new games; not an organ contained in its once sacred interior, or in that of the pelvis, is free from attack, and, for the most part, happily, with as great relief to the patient as pride to the surgeon. The brain, till five years ago the most dreaded organ in the body, is now not only freely exposed without serious danger, but portions of it excised, abscesses opened, the ventricles irrigated, and tumors removed. Bones are sawn or wired, joints are opened, the chest is invaded, and the lungs are resected. These and other operations successfully done are witnesses to the new era in general surgery and in gynæcology, while in each special branch of surgery the same could be shown to be true had I only the time.

In Medicine and Obstetrics the same progress is noted in newer and better treatment of many of the ordinary diseases and the usual obstetrical conditions. The diminution of the mortality rates is simply extraordinary; and often the new methods of treatment are as simple and grateful as they are successful. To name but one department of each: Our acquaintance with diseases of the nervous system has grown so rapidly that a text-book of thirty years ago is apt to elbow Galen and Avicenna for sympathy in its neglect, while the mortality of the puerperal state has been reduced almost to a vanishing point by the introduction of antiseptics.

Of the many specialties in medicine I cannot take time to speak, save to note the fact that they all have been created or remodeled within the last twenty years.

In view of these facts, am I not justified in calling this "The New Era in Medicine"?

It will be the duty, the privilege, and the joy of the teachers in this flourishing and progressive school of medicine to give to you the details of this fascinating medical romance in the course we are now entering upon, and I envy you the privilege of engaging in this study thirty years later than I. I have not used the word "faculty," but "teacher"; first, because I wish to recognize and I wish you to recognize the worth and zeal of the junior teachers associated with us, both in the college and the hospital; younger men who freely give of their time to aid you, and largely for the pure love of science. The best and highest reward that ever comes to them, as to us, or to any mortal, is the inward glow of satisfaction from good work done in scientific research, through which results an enlargement of the domain of truth. "I labor less," said Fresnel, "to catch the suffrages of the public than to obtain that inward approval which has always been the sweetest reward of my efforts. Without doubt, in moments of disgust and discouragement, I have often needed the spur of vanity or emolument to excite me to my researches. But all the compliments I have ever received from Arago, de la Place, or Biot never gave me such large pleasure as the discovery of a theoretic truth or the confirmation of a calculation by experiment."

The word "teacher" also designates us all as members of one of the noblest guilds in the world. For twenty-four years I have also myself gloried in the name and work of a teacher, and desire no better title. It is said that when

Agassiz's will was opened it ignored all his other proud titles and began majestically: "I, Louis Agassiz, teacher . . ."

The new era in medicine so inadequately described now confronts the profession, and especially you, gentlemen, who are to practice it, and whose lives will be spent, remember, among the glories of the twentieth century, with the now undreamed of progress of that happy time. It confronts you as a mighty master, with uplifted hand, pointing you upwards and onwards; onwards to the laborious, but great and splendid, work awaiting your touch, and upwards to the prizes for the foremost and worthiest. But it makes also its demands—its inexorable demands—upon you. Satisfy them you must, or fail.

Let us look for a few minutes at what these demands upon the profession are.

A physician's life consists of three periods: his preliminary education, his medical college course, and his active life as a practitioner. These may be called the Pre-collegiate, the Collegiate, and the Post-collegiate periods, and I purpose speaking in a plain and practical way of each.

1. The Pre-collegiate period, or that of preliminary training.

The ideal medical college would perhaps insist that this be nothing short of a complete liberal education, such as is given in our American colleges and universities. It is an encouraging feature of the times that the proportion of such college graduates now in our medical schools is steadily on the increase, and that one of our numerous medical societies is composed wholly of those who have received not only the degree in medicine, but that in arts as well. Native talent and hard work will always tell, but such talent when trained and set at work will accomplish vastly more. But this is a world of imperfections and limitations in which the Utopia of the ideal-best must give place to the cold, matter-of-fact attainable-best. Desirable as it might be that all of the profession should have such a complete preliminary training, we all acknowledge it to be impossible, at least at present. But such a preliminary education as would at least fit a man to enter the freshman class at our ordinary colleges before many years pass must be, in my opinion, a prerequisite to the study of so wide, so progressive, so logical, and so exacting a science as medicine. If necessary to fit a man to study the ordinary college branches, it would seem *a fortiori* to be necessary for such technical study. Even this we cannot expect at once. But it must be the goal toward which we must strive. I congratulate you and the Jefferson College most heartily on the inauguration this year of an entrance examination—a real, though a moderate one—a beginning that is but a herald, I hope, of more exacting examinations in the future, as thus we grow up to our privileges and opportunities. Moreover I must not forget that I am addressing those who have concluded this first period, and who have already entered, or are about to enter, upon the second. Those of you who have had a complete preliminary training I congratulate, and at the same time I remind you that more is to be expected and exacted from you than from others. Should you pride yourselves upon the privilege and relax your efforts in the least degree, remember that the tortoise once beat the hare, and can do it again.

To those of you that have not had such a preliminary training, the question arises: What shall you do? Recognize honestly the defect and go to work manfully to make up for it just as far and as fast as you can. You can do but little of this, perhaps, during your college course. In the winter you will have no time, and I feel chary of your using your summer holidays for much hard work. But if not now, then so soon as you graduate, when your conspicuous patients—conspicuous by reason of their rarity—leave you plenty of unasked-for leisure, then you must begin with zeal to complete such a desirable education. But more of this hereafter.

2. The collegiate period, or that spent in a medical college.

I will not spend time in a repetition of the trite maxims inculcating due diligence, hard work, regular attendance, close attention, and all that. You were once boys who needed mental and possibly even corporal flagellation. But you are past that period, and are now young men. Not that you have outgrown the need for these virtues, but that we take it for granted that you have them and will use them. We have no rules and no roll call for these very reasons. You are placed upon your honor to do your very "level best." "Education," it has been wittily said, "is the only thing in which we try to get the least for our money." It is for you to prove the falsity of the saying.

In the brief time you will spend here we can tell you but little of the immense array of facts in medicine. You will learn much it is true; but compared with what you do *not* know, what you *will* know when you graduate will be as nothing. The chief services of a medical college are twofold: First, it will give you the great principles that underlie each department, with the main facts that prove them. But secondly, and if possible even more important, it will gives you an impetus in the right direction. The use of a cannon is to compel the ball to follow its proper path. The gun is but a few feet long, but the impetus and guidance it gives in those few feet are unalterable. The huge missile follows its determined course to its goal. If the gun is aimed low its path will be low and its goal will be near; but if the aim be high it will cover miles in its course and triumphantly strike its distant target. Enter then here into the enthusiasm of the place and the time. Catch the scientific spirit pervading the very atmosphere of the place. Let it permeate every fibre of your mental structure. Let it be your meat and drink, your very life. This short period is to give you the "bent," "the set," the "curve" of your whole later professional life. See to it that you use it well.

Remember, however, that while we can "teach," it is you that must "learn." We can but spread the rich feast. It is you who must eat and assimilate it. We give "instruction"; you must transfer it into an "education," and make it an abiding possession. "Pray, Mr. Opie," said a visitor to the artist, "what do you mix your colors with?" "With brains, sir," was the brief, but pregnant, answer.

But while inculcating all this diligence and enthusiasm let me caution you to see to it that your health does not suffer; not perhaps from too much work, but rather from unwise methods of work. The daily bath and a proper amount of exercise will go far to counteract the bad air of the lecture- and dissecting-rooms. Get to bed early; then you know you can get up early, which you all so much long for. Study none on Sunday. Being medical students does not release you from the moral and religious duties and pleasures of the Sabbath—the day of rest—here any more than at home; and a complete change in the current of your thoughts is no less refreshing than it is physiological. One of the worst evils of our present system of education is cramming for examination. A reasonable review of bygone lectures is wise and useful, but cramming is quite another thing. It means that you have been lazy and derelict during the winter, and to make up for lost time you ram and cram your heads full of a mass of unassimilated facts to dole them out parrot-like to the too inquisitive professor. I cannot better present its evils than by quoting from that wise old Grecian, Epictetus, for it seems to be a very hoary vice: "It is," says he, "as if sheep, after they have been feeding, should present their shepherds with the very grass itself which they had cropped and swallowed to show how much they had eaten, instead of concocting it into wool and milk." Next April, remember, we don't want the "grass," but the "wool and milk."

You will learn the use of many new and valuable instruments: The microscope, otoscope, ophthalmoscope, laryngoscope, and all other "scopes"; the many specula, aural, oral, nasal, vaginal, rectal; many beautiful and useful refinements in chemical reactions and in pathological appearances, all useful as means of diagnosis. You must master them all. They are the tools of your profession. If you miss learning their use now you may never again have the chance. In the remote West, in a small country village in the East, or elsewhere, you will sometimes sorely need them, when you will have no willing professor or quiz master to whom you may appeal. They will help you in a multitude of cases, and often are simply indispensable.

But I want to urge you to do one thing more: to combine with all of our nineteenth-century inventions eighteenth-century shrewdness of observation and acute cultivation of the normal, unassisted senses, in order to make up the more perfect doctors of the twentieth century. If you have not read "Spare Hours," by the lovable and accomplished Dr. John Brown, of Edinburgh, the author of "Rab and His Friends," that most charming medical story, you have a treat before you. Some pages are more succulent than others, but there is not a sterile patch among them. In the third series you will find most of the medical papers, and they are bracing reading for a doctor. I know nowhere a stronger plea for this very education of the senses which I wish to urge upon you. As there were heroes before Agamemnon, so eyes and ears existed before oxygen was known or Laënnec lived, and our forefathers had sharp eyes, shrewdly hearing ears, and delicate fingers that had to take the place of the specula and the scopes of our day. "Every fellow," says the blind but knowing master of wood-craft, in Dr. S. Weir Mitchell's last story, "every fellow ought to be blind ten years, and deaf ten more, and then get his eyes and ears. He'd know a heap, I tell you he would."

Medicine is not a deductive science. We do not start from *a priori* principles and reason to conclusions. It is intensely inductive. We collect our facts, the more the better, as increasing numbers diminish the ever-possible chances of error; we collate them in orderly sequence, and gradually rise from facts to principles. Hence if our facts are badly observed, our principles are sure to be erroneous.

I am persuaded that the chief source of errors in diagnosis is not want of knowledge, but careless or insufficient examination into the facts of the disease. I have seen a diagnosis of rheumatism of the knee-joint in a case in which lifting the knee two inches from the bed instantly showed the crepitus from a spontaneous fracture following long-existing osteomyelitis. I have been called to a case of hæmorrhoids which a glance and a touch resolved into an ischio-rectal abscess; and I have seen days of uncertainty and groping for a diagnosis cut short by a few taps over the back of the lungs that revealed an unsuspected pneumonia. Had the leg been once lifted, the perineum inspected and touched, the posterior chest examined—two minutes only, but two minutes of exactness—no such errors would have occurred.

The eye must be taught to take in much for which no speculum is needful. The physiognomy of the patient, the modes of expression, whether facial or vocal, spontaneously assumed postures of the body, tremulous or steady movements, the color, the breathing both as to frequency and character; the outlines of the body, normal or abnormal; the exact relations of parts; all these, and a hundred more, all stand with their cup of information filled to the brim for him who will drink. The ear may be aided by the stethoscope, but it must not be trammeled by it. It must be trained to abnormal alertness, and hear every sound, from the normal loud gurgling of the intestines to the faintest suggestion of it while using taxis in a hernia; from the loud tubular breathing of a widespread pneumonia, to the judicious discrimination of the relative respiratory murmur in the apices. The touch, though it can scarcely be educated up to the standard of Laura Bridgman, can give you the needful facts as to hardness, softness, elasticity, resistance, contour, crepitus, and the like, if you will but use it. No instrument can replace it. Let your fingers therefore itch till you have touched and felt every case that by hook or crook you can lay your hands on. Smell and taste are not seldom called into play, and here at least we can use no artificial helps. Yet they are sorely neglected with all the other senses. The epicure in Juvenal's day could distinguish between an oyster from the Lucrine Lake or from Britain. We could do as much were we to cultivate our natural powers as well. Cultivate these senses largely by a study of your own body. *Haud inexpertus loquor.* The hours I have spent in such study have been among the most remunerative, not only in the facts learned, but in the exact methods acquired, and the fine filing of the senses to a cultivated acuteness.

In all this I would not decry the use of the modern instruments of precision. Their introduction marks the beginning of modern science, when the balance, the yardstick, and the pendulum took the place of vague guessing at weight, length, and time. But, back of all our medical instruments, without which they are almost worthless, are our natural senses. Fifty instruments, though they can aid the five senses, can never replace them. In mountaineering, the Alpenstock is invaluable as an aid; but it can never take the place of a stout pair of legs.

This careful development of the senses should foster a spirit of exactness in all your work; in the use of instruments of precision as well as of the senses themselves. Science is always hostile to the word "about"—"about three inches long," "about one hundred and one degrees," "about ten days." When it is so easy to use the measure, the thermometer, the calendar, why say "about"? In the history of a case as derived from the patient, it may do very well; but in your own later notes it should never appear. One of the surprising and characteristic differences between most of the laity—even very intelligent men and women—and ourselves is their inaccurate observation or non-observation of plain facts. This is due solely to the want of training of their natural senses, and is the best argument I can give you for the schooling of the senses.

I am well aware that during your collegiate course you will have only moderate opportunities to use Nature's gifts—in my day we had none at all—and that most that I have said will apply rather to your post-collegiate course. But the accurate scientific habit or the shiftless unscientific habit will be begun and largely formed here, and it is generally true that what your habits are when you graduate, such they will be until Time shall administer his last anodyne and you pass into your long sleep.

Given the facts, accurately observed and carefully noted, what then? Then comes the highest art of the physician: the reasoning process by which is evolved his diagnosis, upon which depends his treatment. He must take one plus one and make them into two, a *tertium quid* wholly distinct from either of its constituent factors. And in medicine the two ones often lie far apart. They must be correlated not only in any individual case, but in cases years asunder, by a mental stereoscopic vision, the possession of the few, the envy of the many.

This logical faculty is partly inborn, it is true, and varies in natural strength as much as the natural acuity of vision; but it is also amenable in an immense degree to cultivation. The wider your knowledge, the better your reasoning will be. You must at first laboriously toil over the process, as does the tyro in Euclid over every equation in each successive problem, over and over again. But when these steps have become as A, B, C to him, then he begins to leap, and finally, when a master geometer, his "therefore" clears a whole book at a bound. So with you, the halting method of your early days, if carefully purified from its faults and strengthened by constant and watchful repetition, will at length give way to quick perception; the correlated facts soon become as familiar to you as his old friends, X, Y, and Z, are to the geometer, and with a mental "therefore" you, as quickly and as accurately, leap to your diagnosis, and thence to your treatment. Painstaking and habitual induction slowly give place to intuition. To the laity it often seems so easy and takes so little time that it is hardly worth paying much for. They should learn that it is like the ease of the accomplished athlete, the swordsman, the equestrian. As in a plant, the long roots are hidden; only the brilliant flower is seen.

Of treatment, the last and most important point of all—the "final cause" of there being any doctors at all—you will hear and see so much that I will only quote Broussais: "The real physician is the one who cures; the observation that does not teach the art of healing is not that of a physician: it is that of a 'naturalist.'" And I add my commentary: "The observation of the naturalist must precede, as it ought to lead up to, the art of the physician."

You will be much tempted to devote yourself to one or two favorite branches, to which you perhaps think you will devote yourself later as specialists, and to neglect others. No greater mistake could be made. Few men follow their early selection of a career. Circumstances compel a change. This collegiate part of your course stands in the same relation to your later professional life that a common school education does to your general education.

Everyone must know the three R's whatever he may be, "farmer, lawyer, doctor, chief." So every doctor must know chemistry, though he become a surgeon; the eye, though he practice medicine; the microscope, though he become an obstetrician; obstetrics, though he turn out a pathologist. Each is a strand in the stout medical rope, and without it the rest would be weak and worthless. You must "know something about everything, and everything about something." Every department of medicine must pay tribute to the one you finally select. As Iphicrates, the Athenian general said, when asked why he was so proud: "Are you a soldier, a captain, an engineer, a spy, a pioneer, a sapper, a miner?" "No," said Iphicrates, "I am none of these, but I command them all."

3. The Post-collegiate period, or that of actual practice.

"Commencement" is not inaptly named, for it is the beginning of the work of life. I was not idle as a student, but I am sure that I have labored twice as hard since I have had my coveted sheepskin as I ever did to get it. "In nature," says Emerson, "nothing is ever given away. Everything is bought." For some things we pay dollars, for others, time; for others, hard labor. Time and hard labor are the sure and only currency of the realm of medicine. These alone bring success. And by "success" I do not mean wealth, or influence, or fame, the presidency of this medical society, or a professorship in that medical college. Success is a relative term; related to our sphere in life and our opportunities. There is a dignity in mediocrity, as well as of greatness. The humble country doctor—like the Gideon Gray of Scott's romance—if he has kept abreast of the times by after-study, and has made the most of himself and his opportunities, has achieved true success. Let me now enumerate some of the means needful to this end; especially needful in view of the demands of the new era.

A doctor who takes no medical journal is like the business man who takes no newspaper. Years after graduation he stands just where he did when dubbed an M.D., barring a certain amount of rule-of-thumb experience he may have obtained. He is like a mariner who would stick to Fulton's antiquated steamboat instead of an Atlantic liner. The medical newspaper stands in the same relation to medical books that the daily newspaper does to works on history;

the one gives us the current events and thoughts and discoveries of the time, sometimes true, sometimes false; the other consists of the sedimentary deposits, gradually hardening into the rock of well-ascertained facts. To keep up with the rapid progress of medical science you must, therefore, first of all take as many medical journals, and also buy as many books as you can afford. Make a note of every paper of importance in an index rerum, or better by a card catalogue, such as is used in all our libraries. Skimp your table and your wardrobe that your mind may be fed and clothed. This is your capital in trade.

Carry with you into practice the habits of accuracy, the healthy use of your senses that you will begin here. Accept all the helps modern science has given and the many others yet to be added to them. Study each case, especially your early ones, till you know them as you know the topography of your own at that time too unfrequented office. One case thoroughly studied will do more to enlarge your knowledge and teach you methods than a score observed in a careless, slovenly manner. Make notes of every case you have, full notes for the important ones, slight for the trivial ones. What would I not give had some one offered me and had I heeded just this one bit of advice! Patients soon come to the man who is interested in each case, studies it thoroughly, and, therefore, as a rule, cures it surely and quickly.

Now, too, will come the time when you can remedy any defects of early education. If you do not know German and French, you should begin to acquire at least a reading knowledge of both, within a week after you have your diploma, possibly even before you get an office. You have conquered a new realm when you have acquired a new language. No medical man at the present day can, by any possibility, afford to be ignorant of at least these two. If he is, he simply must go to the rear. With these I must enter a plea for the sturdy, sonorous Latin, and if possible some Greek. Never forget that ours is happily one of the "Learned Professions," and if we would be worthy of the name, some little classical, as well as scientific, learning should shed a halo around it. Not only are they needful for your very first prescription, and for the intelligent appreciation of most modern scientific terms, but they lead to the highest and noblest literature. If you have once tasted of the honey of Hymettus you will hardly be satisfied with the miserable stuff found in many of the current and much-be-thumbed books of the day. A literature that has dominated the world for over twenty centuries has a right to claim some of your time.

Do not shelter yourselves behind the incessant work and endless drives of a "country doctor." I fear that many of our country doctors waste enough time in gossip and profitless discussions of the crops and politics, and what not besides, to make them excellent Latin scholars at least. Even the long drives alone, if rightly used, would suffice to add one or two languages to their literary furnishing. One of the most remarkable medical pictures of the time is that given by Dr. John Brown, of Dr. Adams, of Banchory, a "country doctor" in a secluded Scotch village, with constant hard work on horseback, amid bleak hills and valleys for twenty miles around. Without ever neglecting his work he became one of the most accomplished linguists of his day, and at breakfast was fond of amusing himself by translating an ode of Horace into Greek verse.

A happy distinction has been made between the "Literature of Knowledge" and the "Literature of Power." Our science brings us so constantly into contact with the first that we are apt to neglect the second. Much of the literature of power you will find in Homer and Demosthenes, in Horace and Cicero, in Molière and Goethe; but for a wide acquaintance with it you must naturally look to our mother-tongue—and, happily, you do not look in vain. Chaucer and Shakespeare, Milton and Macaulay, Tennyson and Thackeray, Whittier and Longfellow, Webster and Irving, and the genial Oliver Wendell Holmes—one whom our own guild ever delights to honor—these will conduct you into the higher realms of thought, where you may soar undisturbed by care. "Some books," says Bacon, "are to be tasted, others to be swallowed, some few to be chewed and digested." Read the books that are to be eaten and assimilated.

I urge this literary culture partly because it will afford endless delight and broaden and inform the mind. In later life, when you have lost some of the fine enthusiasm of youth; when the years come that bring the philosophic mind, familiarity with such a literature will be a never-failing resource, for it never loses its charm. But I especially urge it because the new era in science demands that you be ready to report your cases, relate your discoveries, and discuss them before an intelligent public. To do this so that you will command a hearing, a good English style is indispensable. Few scientific men speak or write effectively. They are apt to be illogical in their methods, wanting in force in their arguments, discursive and inelegant in their style. If you will make the literature of power your companion, and then will write and then prune mercilessly, you will soon acquire such a command of English as will serve you many a good turn. The secret of Huxley's and of Tyndall's influence lies as much in their forceful and elegant English as in their scientific acquisitions.

Besides all these scientific and literary demands, I cannot pass by those personal qualities that the age requires of every gentleman. Cultivate, therefore, neatness of apparel, a courtesy that is so apparent that it is extended to the humblest patient in as large measure as to the rich and influential. Appreciate that yours is not a trade in which to make the most money in the least time, but a generous profession, by which, it is true, you make a living, but also do far more. You give what money cannot pay for, and for which you will often never even ask for any sordid *quid pro quo*. Devotion to duty to the neglect of self, sympathy and succor in the hours of sorrow, cheerfulness that vanquishes despair, and skill that baffles even death itself, these are not to be paid for by money, but by speaking eyes, grateful hearts, and well-cemented, lifelong friendship and devotion.

Above all, cultivate that good old virtue, "common sense." It lies back of all your science. It is the bed rock on which all success is based.

Of your moral and religious duties I may add only a word. Medicine has to do with much more than the mere healing of human infirmities and disease. Its investigations carry you far beyond the animal kingdom, away down to the lowest vegetable organisms, which bacteriology has shown to be such important factors in disease; its practice has to do with the health and highest happiness of vast communities, as well as the welfare of each individual, with all his various ties and relations, in our complex social life; and its speculations carry you far above and beyond the hour of death. We assist at the beginning of the earthly life in its frail cradle; we see its very close when we watch the last respiration and feel the last pulse-beat. That this is not the "be-all and the end-all" of a human soul, both Holy Writ and our own inner conviction imperiously assert. If we could but discern it, we have really assisted at the beginning of a second and the greater life—the Eternal Life. Mindful, then, of our high calling, we should be thoughtful and religious men, ever asking for the Divine help in our daily round of duties.

When I began writing I had intended to speak at length also of the demand of the new era in medicine upon our medical colleges. Time, however, will only allow of a brief, but most important allusion to it. To this demand the colleges are slowly responding. But the change should be more general, more rapid, and more radical.

It is one of the most healthful signs of the times that it is in the larger and more advanced schools, the very ones that are best equipped as to men, money, buildings, and laboratories, that there exists the greatest unrest and dissatisfaction with present achievements, and the chief reaching forward to better and larger things. Among these stands the Jefferson Medical College. While conservative, she is progressive; "*Nulla vestigia retrorsum*" is her motto. That she is alive to the need of progress and has met it in the past, the contrast I have described between my own student life and yours gives ample proof. That the new era in medicine demands still more she recognizes, and, as you will have seen by the announcement, she again meets the demand. To your joy no less than to mine, for the student-mind is ever alert to notice signs of progress, this year we inaugurate a full and required three years' graded course. Time was when the comparatively narrow field could be reaped in two combined hearty attacks. Even then it was hard work; but now it has become simply impossible. The profession and this college alike recognize it, and accordingly we provide for it. If, with increasing branches of science, and increased demand for a deeper as well as a wider knowledge, a reasonable experience shall, as I believe it will, conclusively show that more is needed, I am persuaded that the Jefferson College will recognize that need, and provide for it in due time.*

In connection with this progressive step, I am glad to be able to announce to you that, during my late visit abroad, I had an interview with Mr. Hallett, the courteous and intelligent Secretary of the Conjoint Board of Examination of the Royal College of Physicians of London and the Royal College of Surgeons of England, and that these two colleges have accorded to the diploma of the Jefferson Medical College

* The three years' graded course was quickly followed by the establishment of the four years' graded course.—(W. W. K., 1905.)

precisely the same rights and privileges that are accorded to the diploma of the universities of Paris, Berlin, Bologna, and all the best foreign schools.

As an earnest of the progressive disposition of this college, I have also the honor of making to you another announcement. Within a short time, the wise forethought of the Board of Trustees has been well shown in the purchase of a lot eighty-two feet in front on Walnut street, south of the hospital, upon which a new and commodious college building will be erected, an ornament to the city, and a more active center of scientific life. Nor will the old and battered college building be given up to baser uses. Hallowed by the memories of McClellan, Dickson, Mütter, Bache, Pancoast, Dunglison, Gross, and scores and hundreds, yea, even thousands, of earnest teachers and pupils, and remodelled, it will take a new lease of useful life by gathering under its hospitable roof the many well equipped laboratories of the college, all of them the product of the last twenty-five years. This is happy news, especially to the workers in the ill-equipped, insufficient quarters of the past, which yet have been the scenes of persistent, patient, and most useful scientific work.

But to erect a new college building and alter another, and equip the laboratories, will take money, and a deal of money. For this we must appeal largely to the generous sympathies of a community long noted for its intelligent benevolence. Yet it is an odd fact, to which I call especial attention, that, while to academies, colleges, seminaries, and other institutions of learning, millions have been given, and to hospitals scores of millions, yet, to fit the men who are to serve these very hospitals, to educate the doctors who are to have the health and lives of the whole community in their care, nothing has ever been given until of late. At last we are awakening to the fact that good doctors are as important as good teachers and preachers, and that physical health is no less important than mental development. To erect suitable buildings for an important medical school, and to equip and endow its laboratories and museum, is as much a work of philanthropy, and brings back ultimately to the community as large a return as similar gifts to academic institutions or to hospitals. We have already hospitals and dispensaries, and asylums and homes in excess of the needs of the community. What is needed now is the strengthening and development of the *medical schools* which educate the men who make the hospitals useful; the endowment of laboratories in which original research will continue for all time; researches which will repay for their outlay a thousandfold; and the establishment of scholarships and fellowships, to enable young men whose devotion to a scientific career is hindered and often blighted for want of reasonable pecuniary help. For these innovations and encouragements we now ask money, and the indications are that the community is alive to the need for them. The recent endowment of the Chair of Surgery in the University of Pennsylvania, the erection of the new buildings at Harvard, the establishment of the Carnegie, the Loomis, and the Hoagland laboratories, and especially the magnificent gifts of the Vanderbilt family in New York, and of Johns Hopkins at Baltimore—all these are encouraging signs.

The Jefferson now boldly proclaims its work, and asks for similar help. The new era in medicine compels us to enlarge our facilities, and this wider and better instruction will benefit the public at large. To them we appeal confidently, knowing that they will not disregard an appeal founded alike in justice, mercy, and charity.

And the reasons urging on this college to these large and wise advances apply equally to the other medical schools, and to the profession at large. The demands of the new era in medicine will only be complied with when the medical colleges give all the necessary facilities in equipment and in time, to study thoroughly every branch of medicine, and the student comes to the college with a suitable preliminary education, avails himself during his college course of the ample means provided there, and after graduation grows into the cultured and experienced doctor by the means and methods I have pointed out.

THE REAL REWARDS OF MEDICINE.*

Gentlemen of the Graduating Class:

THE revolving cycle of the passing years makes it to-day my pleasing duty to say a parting word of advice, of caution, and of cheer to you. And first let me say the word of cheer; not only because it is the pleasantest to be spoken, but because in your earlier years of practice you will need it far more than any other word I could speak to you. I am sure that the public do not understand, nor do they appreciate, not only the many years of study before a young doctor can even begin to be self-supporting, but the many years of discouragement, with an empty purse and accumulating bills, which beset his early professional life. Should he desire to enter upon the profession *thoroughly* equipped, it means, first, the years of preparation in the common schools, from seven to eighteen; then four years in college; then four years of study in the Medical School; then at least a year in a Hospital, and, if possible, a year or two abroad. In other words, *twenty-one years of study* are practically what is required completely to fit a man even to begin to earn his living by the practice of medicine in any of its branches.

And in his earlier years the doctor is paid in many cases far less than the pittance which is bestowed even on the humble day laborer. I remember very well one of the brightest young men in the profession, who had all the advantages I have just described, and who, some time after

* The Valedictory Address delivered at the Commencement of the Jefferson Medical College, May 2, 1893. Reprinted from the College and Clinical Record, May, 1893.

having "hung out his shingle," came to me greatly discouraged and said, "I think I shall have to give up the practice of medicine." "Why so, Doctor?" said I in surprise, knowing his ability and future promise. "Because," said he, "I do not think I can earn enough to support myself and my wife" (for he was already married), "and I do not wish to be dependent all my life on my father." "How much have you earned by your practice since your graduation?" I asked. He replied, "It is now seven months since I opened my office, and I have received exactly $2.50." In other words, in 210 days he had received a little more than one cent a day! And in my own personal experience, when I had been in practice for five years, in the month of June, I paid and received, all told, seven visits, of which three were charity visits, two patients ran away and paid me nothing, and two paid me $1.00 each.

Many years ago I was returning in the street cars, at six o'clock in the morning, from St. Mary's Hospital, where I had spent the entire night in attending to the victims of a terrible fire in a mill, and, seeing my case of instruments, a laborer, evidently an intelligent man, just starting for his summer day's work, accosted me and wanted to know where I had been. Upon my telling him what I had been doing, he said to me: "I suppose you'll get a right good salary for working all night and doing a lot of operations"; and he was completely dumbfounded when he learned that not only had I gone to the hospital at my own expense, but had served the institution for years without charge, and that every hospital surgeon, hospital physician, and hospital resident in the city gave his labor and the best work of his life for years entirely free of charge to the patients under his care.

Yet time brings its rewards, and you will find if you do good work that your friends and neighbors will after a time surely recognize your merit. If you have genius you may gain a fortune; but even mediocrity is sure of a competence if you are faithful and honest in your work. No man need ever despair of making at least a decent living by the practice of medicine.

But pecuniary rewards are not the best that you will get, if you cultivate everything that ennobles the profession and discourage all that tends to make it merely a trade by which to make money. What, then, are the real rewards which the profession of medicine holds out to you? They may be sketched somewhat in the following manner.

First, you will enjoy a sense of daily duty faithfully performed. This fills a noble heart with a glow far beyond the satisfaction of an expanding balance in bank or a growing hoard of stocks and bonds.

> "Count that day lost whose low descending sun
> Views from thy hand no noble action done."

If you do, you may be sure that no day will be lost, but that each will be counted among your gains. Duty is often irksome drudgery; but put your heart into it and the lowest drudgery becomes the highest service and will not fail of its reward. As quaint old George Herbert says:

> "A servant with this clause
> Makes drudgery divine;
> Who sweeps a room as for Thy laws
> Makes that and the action fine."

Life, for the most part, is a matter of trivial details. The growth of character, like all other growth in nature, is the result of the steady, multiplied activity of many small parts. The giant oak which resists the stoutest storm does so because in the many days of soft rain and bright sunshine its roots were slowly spreading far and wide in the fertile soil by the growth of cell upon cell and fibre after fibre, its strength being tested and confirmed by summer breezes and occasional wintry winds, and at last when the storm comes in its fury the mighty tree has so faithfully done its duty in its minute, but constant, growth, that it stands unmoved and unassailable. So the small daily duties of life, if faithfully performed, will gradually develop your character and fix your principles so firmly that the storm of temptation, however violent, cannot bend or swerve you from the path of duty.

This daily duty may lead you into danger, which you must face with the coolness and courage of the soldier on the field of battle. True, for the soldier of science and of duty there is no blare of trumpets, no beating of drums, no shouts of the combatants, no public honors, no laurel wreath, for the young physician is in the lowly home of poverty, battling with the angel of death, exposed to the poison of diphtheria, of yellow fever, of cholera, or of typhus, and may himself fall in the encounter, a victim to his brave sense of duty to his patient; and the surgeon in the hospital exposes himself daily to the dangers of blood-poisoning, dangers which I have seen in more than one case cut short a life of promise and hide it in the grave. But he lives in grateful hearts, unknown though he may be to the pages of history, or even beyond a small circle of equally obscure friends. But their prayers and cries are heard of the good God, and the Recording Angel will enter every such unselfish deed in God's Book of Remembrances.

"They have no place in storied page,
No rest in marble shrine;
They are past and gone with a vanished age,
They died and 'made no sign.'
But work that shall find its wages yet,
And deeds that their God did not forget,
Done for their love divine—
These were the mourners, and these shall be
The crowns of their immortality.

> "O! seek them not where sleep the dead,
> Ye shall not find their trace:
> No graven stone is at their head,
> No green grass hides their face;
> But sad and unseen is their silent grave—
> It may be the sand or the deep sea wave,
> Or a lonely desert place;
> For they need no prayers and no mourning bell—
> They were tombed in true hearts that knew them well."

No other calling has ever had such a multitude of brave, unselfish, unknown, silent martyrs, who have freely risked all that is dearest and best, even to life itself, as our own Profession. Their lives have not been lost, for, as Ruskin has well said, "Every noble life leaves the fibre of it interwoven forever in the work of the world."

Not only will you have this sense of daily duty well done, but if you use your time well there will be a daily personal growth in knowledge. To this end, study after you have graduated, as you have never done in your so-called "student life." Make even your failures a fertile soil for a larger growth and better achievement, for

> "The tree
> Sucks kindlier nurture from a soil enriched
> By its own fallen leaves; and man is made,
> In heart and spirit, from deciduous hopes
> And things that seem to perish."

You will have earned each day a certain modicum of money, but you will also have added to the store of knowledge in your mind, to be of use to your future patients; so that your gains cannot be measured merely in dollars and cents, but in wider knowledge, in pregnant ideas, in mental growth, in better judgment, in a better balanced mind, and in masterful ability to cope with dangers by reason of such larger knowledge.

More than this; you promote the general welfare and add to the prosperity of the community in which you live, by directly diminishing the loss of time and money to the wage-earners of the community. You restore the sick mother to the charge of her household, the disabled father to his family —nay, in not a few cases you save life itself. And how much a single life may mean to a man's wife, his children, his business, his church, his community, his nation! Even if you cannot save life, you lessen suffering and bring cheer into the sick-room, and you smooth the pillow of death itself.

In Preventive Medicine you can do still more, and on a far larger scale, by educating the community as to personal and municipal health, by pointing out the evils of dirt, of filthy streets, of foul sewers, of impure water, of tuberculous meat and milk, of crowded tenements, of unwise clothing, of want of exercise, of want of the daily bath, of errors of food and drink, of vile habits, and a host of other enemies to human health and happiness. This, believe me, is to be the greatest function, the most splendid achievement of the coming years.

And, lastly, in this brief sketch which I am giving you, you should do one thing more. Remember that science looks to you for enlargement of its boundaries, by conquests in the domain of ignorance. I envy you your position on the threshold of the glorious twentieth century. The passing century has seen great victories, but the next one will see far more. Our profession is not complete, "*totus, teres, atque rotundus*," but I believe it has, as it were, just begun its beneficent career. The discovery of Anæsthetics and of Antisepsis, and the creation of the science of Bacteriology have been the three great triumphs in medicine of the nineteenth century. You enter upon this great heritage, freely bequeathed to you by your predecessors, you begin where they left off. With such advantages you should make still greater advances, and I believe that you are on the eve of still more blessed and portentous discoveries. The cause and the cure of the great destroyers of human happiness and human life are to be discovered by you. You may vanquish cholera, consumption, typhus, yellow fever, scarlet fever, and other demons of disease, and there may be even in your own class—why not?—an unsuspected peer of Harvey, of Jenner, of Lister, of Pasteur. By carrying on to its utmost limits the good work already begun in the Jefferson Medical College, by earnestness in study, by exactness in observation, by gathering your facts, shrewdly comparing and correlating them, by wise experiments to ascertain the correctness of your conclusions, and then by publishing them for the information and enlightenment of the profession, you will fill out the duty you owe to the Community, the College, and the Profession. The Alumni of the Jefferson Medical College, whose ranks you join to-day, have reason to be proud of the contributions to science made by the dear old College. Its large and constantly enlarging body of Instructors have always been in the forefront in the intellectual arena of Medicine. It was not less a matter of pride than of delighted surprise to me, not long since, when, apart from all the splendid work of its Alumni scattered all over the world, *a partial compilation of the books and papers published in two years only by the teachers connected with the Jefferson showed that they had published* 267 *contributions to knowledge*—almost one paper every two working days. See that you keep up—nay, more, that you extend—this scientific spirit, so fruitful of blessings to humanity.

We are about entering on a new era in the history of the College. Its educational and charitable work have both been hampered for the past twenty years, to a degree only appreciated by those engaged in the daily work of teaching in the College and in caring for the immense number of patients in the dispensary service of the Hospital. Here, again, the community is in utter ignorance of the enormous amount of charitable work done in the hospital. At the end of my recent term of service of only *eight weeks* in the clinic, I reported to the Trustees that in addition to all the work in the surgical wards, in which there were nearly 50 patients requiring daily care, *there had been* 5005 *visits in these* 48 *working days, and exactly* 200 *operations done,* many of them of the most serious character, and without a single death.

This, mark you, is only the record of eight weeks of the entire year and in one department alone. If to these figures you add all the cases in the clinics for Medicine, Obstetrics, Gynæcology, Diseases of the Eye, of the Throat, of the Ear, of the Nervous System, of Children, of Orthopædic Surgery, of the Skin, etc., the sum-total is simply enormous. And all this is done in a Hospital built before these numerous clinics were even thought of, and in quarters lamentably deficient in space, air, and light.

Besides this charitable and scientific work, you know even better than I can tell you the absolute need for enlargement of the facilities in the various laboratories and lecture-rooms, requisite for teaching over 600 earnest young men every year. The simple fact is that we have outgrown—immensely outgrown—the facilities which our buildings afford. The four years' graded course, now voluntary, must soon be compulsory, and we will be worse off than ever. Hence the bold plan for the new buildings in a new and splendid location. The Trustees and Faculty are cordially united in their efforts for a "New Jefferson," and we appeal to the public of the State and of the City for aid.

Colleges, theological and technical schools, and hospitals have been endowed with millions, but who except Johns Hopkins has ever endowed a medical school? Yet here are educated the doctors who make or mar human lives in these very hospitals and in the entire community. As alumni of this now ancient and honorable school, you can assist in shaping public sentiment in this direction. We appeal to this charitable community to aid us in the great work of training their medical attendants to the very highest point of scientific and practical skill by gifts which will be repaid to them a hundredfold in their own lives and health and that of those dearest to them.

I welcome you, then, finally, into the goodly company of earnest workers and soldiers of knowledge in the campaign against ignorance and disease. Be an honor to the College, true to yourselves, and faithful to your fellow-men and to God throughout your lives, and His gracious benediction, "Well done, good and faithful servant," will be your final and blessed reward.

MEDICINE AS A CAREER FOR EDUCATED MEN.*

"BEAUTIFUL for situation, the joy of the whole earth," was the description of ancient Jerusalem by its enthusiastic admirer. And surely anyone looking on Pardee Hall would be justified in applying this encomium to Lafayette College. It is a genuine pleasure to me to join with you in your annual festival when your tribes come up to their intellectual Jerusalem, "singing their songs of *degrees*" as of old. And although the son of another academic mother, I rejoice with you in the prosperity and glories of your noble college. I see around me old men, graduates of the forties, with silvered heads, their paths in life chosen, their duties fulfilled, their lives culminating in honored, cultivated leisure and wide influence, whose achievements are recorded in the history of the world of art, science, literature, language, business, and religion. I see, again, men in middle life, graduates of the sixties and seventies, alert for every opening for the best work in the world's great enterprises. They are in the forefront of the fight against ignorance, vice, and irreligion.

But it is rather to the young men, and especially to you, gentlemen of the graduating class,—who are now taking leave of these classic shades where you have spent the four most blissful and fruitful years of a man's life, to which he ever reverts as the halcyon days of youth—to you that I espe-

* The Commencement Address at Lafayette College, June 13, 1893, and (with slight changes) the Phi Beta Kappa Address, Brown University, June 20, 1893.

cially address myself. The joys, the trials, the studies, the achievements of your college life are now, or soon will be, over. The world stands open before you. "What shall I do?" is the question of questions to you. The decision of this question may make or mar you.

If you decide rightly you will achieve success, honor, happiness, and the final consolation of a life well and nobly spent. If wrongly, your decision may wreck, even hopelessly, a young life full of brilliant promise. You and your fellows in the many colleges of the land who will graduate in this leafy June have on your side youth, with all its potencies. You have a just and laudable ambition. You are ready to work your finger-nails off. You have trained intellects. You are members of the true aristocracy of learning, men of marshalled forces, the hope of the nation, the future natural leaders of thought in public and in private life. What shall you do? "Surely," says Carlyle in his Biography of John Stirling, "the young heroic soul entering on life so opulent, full of sunny hope, of noble valor, and divine intention, is tragical as well as beautiful to us."

It is of equal importance to the community as well as to you that you elect wisely what path you will follow in this busy world. Some of you will enter commercial life, lured possibly by hopes of material reward. Some may be devoted to art, with its æsthetic enjoyments. Some will find in literature the contentment and fame that come to the successful author. Some will devote your lives to the highest human function and service to your fellow-men, in winning them to Christ-like lives and heavenly aspirations. Some will seek the noble profession of the law and will become leaders of the bar and wear the ermine on the bench. Not a few, I hope, will devote yourselves to a scientific career, with, it is true, its ceaseless toil, but also its fascinating investigations, its splendid discoveries, its beneficent inventions.

It is my desire to lay before you some of the rewards, the possibilities, the attractions of such a scientific life, and to win you to its pursuit, since it has attractions—wonderful attractions—from many sides and for every type of man, excepting always the lazy. I have selected as my topic, therefore, "Medicine as a Career for Educated Men."

I am met at the outset by the query, "Are there not already too many doctors?" Yes; far too many poor doctors, but far too few good ones. Webster's oft-quoted remark that "there is plenty of room at the top" is as true of medicine as of any other profession. In any profession there is always a reserved seat in the front row for a March, a Faraday, a Schliemann, a John Hunter, a Lister, a Virchow, a Pasteur, a Gross. And although no one of you may become the peer of those I have named—and yet why should you not?—still there is always room right next to them for the trained intellects who will make their profession an integral part of their lives and devote themselves earnestly and truly to its pursuit. Never has there been in medicine such a demand for men of the highest type, the deepest insight, the profoundest spirit of investigation. Never have there been so many questions of grave import to the human race awaiting solution. The mighty problems of life and disease and death crowd upon us and await the touch of a master-hand to make the obscure clear, to avert the dire results of accident, to stay the hand of the Angel of Death and say in dominant tones: "Thus far, and no farther."

Medicine is looking to just such well-equipped, thoroughly trained men as you for its champions in this daily fight with death. And if you wish to rise above the dull level of mediocrity it will be to you college men that the renown which is the proper object of a laudable ambition will surely come. President Thwing, in the June "Forum" states that Appleton's "Encyclopædia of American Biography" contains the names of 912 doctors, of whom 473 were college-bred men. The "Medical Record," commenting upon this fact, estimates that 300,000 men have started out in medicine in this country during the present century. If so, the chance of the ordinary doctor's becoming famous is about one in 300. But if he be a college-bred man it is about one in six. The profession, as I have said, is filled to repletion with poor men and untrained men. What we want is the men fresh from the laboratories of the best colleges, men whose minds are trained in logical methods, who are versed in the "humanities," who possess refinement and culture, who, having eyes and ears, have learned to use them to the best advantage. In that delightful book, "The Gold-headed Cane," Radcliffe—he of the library—visits Mead in his library and says: "As I have grown older, every year of my life has convinced me more and more of the value of the education of the scholar and the gentleman to the thoroughbred physician. Perhaps your friend there (pointing to a volume of Celsus) expresses my meaning better than I can myself when he says that this discipline of the mind, '*quamvis non faciat medicum, aptiorem tamen medicinæ reddit.*' "

The signs of the times point to a closer affiliation of colleges and medical schools, which will be equally advantageous to both. Five years ago nearly all the medical schools in this country were two-year schools. Now nearly all have the three-year courses and a few four, and the new Pennsylvania law requires four years of study, of which three shall be in a medical school. This movement in the direction of a more thorough education means that the medical schools desire to offer a curriculum worthy to attract the best educated men. Moreover, the medical schools are endeavoring to adjust their courses so that they will be the natural continuation of the college courses. Without sacrificing the symmetry and completeness of the college curriculum or abridging the studies for the medical degree, their aim is so to adjust the two that they shall be linked together as one complete whole. Thus many of the medical schools are considering what means can be adopted to draw into affiliation with them the colleges and college men in preference to others. The larger development of the Jefferson Medical College, of the medical departments of Harvard University, of the University of Michigan, of the University of Pennsylvania, and of Johns Hopkins, are evidences of the same wish to win the college men to a medical career. The union of the College of Physicians and Surgeons with Columbia College as its medical department, and the projected absorption of one or more of the Chicago medical schools into the University of Chicago show the same tendency. Moreover, the colleges are looking equally toward the medical schools, as I have pointed out, by the establishment of courses which will naturally lead up to medicine. In Brown University the same movement is actively taking shape through the Brown University Medical Association, and in several universities with medical departments similar steps have already been taken. It is a movement full of promise.

If any of you look forward to medicine as a career you should view it from three different standpoints.

First, on its economic side. This is a matter of no little importance, for every man in this world must earn his living and also naturally looks forward to the support, not only of himself, but of his wife and children in the future. No one should expect in medicine to make a fortune. A few doctors do so, but they are the exception. But every man who enters medicine, if he will be faithful and honest in his work, and *a fortiori* the more intellectual college man, can be sure of a competence,—nay, more, can be sure that he will enjoy not only the reasonable reward of toil, but be able to lay up sufficient for his own old age and for his family.

Secondly, a much more elevating and attractive side is the philanthropic or humanitarian. The medicine of the future will be chiefly in the direction of that most philanthropic object, the prevention rather than the cure of disease.

Hygiene or Preventive Medicine has only arisen within the last forty years. It has already done much, but it promises far more. If it is necessary to show that the knowledge of hygiene is still limited, look at the recent reports on the sources of the water-supply of New York. Nay, you need only go into the slums of your own city; or if you live in the more God-blessed country you may find a startling ignorance of the laws of health in almost every farm house. Nay, more, you need only cross-question a half dozen of your intimate friends as to their modes of life to discover that the laws of hygiene are "more honored in the breach than in the observance."

That there is ample room for missionary work in the matter of personal cleanliness alone will be evident from two recent incidents in my clinics at St. Agnes' and the Orthopædic Hospitals. At the former, as I uncovered the feet of a woman to examine them in consequence of an accident, I was startled at their condition and asked her when she had had a bath. "And phwat's that?" was the innocent reply. At the latter, last winter, after examining the spine of a young lady of sixteen, the daughter of a respectable farmer, I said to the parents with a bluntness born of indignant surprise, "It must be a long time since your daughter has had a bath?" "Why, yes," said her father, "I don't believe she has been in a tub in a year." To which his indignant wife replied, "Why of course she has, John. Don't you remember that bath she took last summer?" They probably agree with a witty medical friend who seriously avers that "everybody ought to take a bath once a year whether he needs it or not."

A recent census of a portion of the Chicago slum district also has disclosed the fact that in a population of 16,000 there were but *four bath-tubs*, and two of these were disconnected from the water-supply! The entire community suffers from such indecency, uncleanness, and necessary ill health of a part.

What a fruitful field there is in hygiene both for scientific and benevolent teaching as to plumbing, drainage, ventilation, clothing, food, drink, city architecture, city streets and sewage, city water-supply, city parks and play grounds, and the eradication of all the evil influences which confront us, both in country, and especially in city life! Many diseases are now recognized as preventable if the community were only alive to the necessity and the possibility of their prevention. "For every case of typhoid fever," it has been said "somebody ought to be hung"—a rough and epigrammatic way of stating what is undoubtedly true, that in a perfectly regulated community there would be no typhoid fever.

But besides such public benevolent service, there is a personal philanthropic side of medical life, to which I gladly advert. Picture to yourself the daily life of the doctor. It has undoubtedly its trials, many and great. The humdrum recital of ancient aches and pains sometimes becomes irksome by repetition. The doctor has patients upon whom he has bestowed unremitting care and his very best mental and physical powers, who have proved ungrateful and have even become his foes. He does an immense amount of unrequited service. His nights are disturbed, his days are not his own, of his family and friends he sees but little. But then, what calling does not have its trials? In what life is there not friction, which, as in mechanics, should be allowed for, and not permitted to become a source of irritation and annoyance? But in spite of all these trials, the doctor's life is so rich in its personal rewards, in its humane service, that it ought to be to him a daily joy.

There is to him a daily personal growth in knowledge. Every sick-room is a school-room, and every case a lesson, from which he comes a larger man. There is a daily personal growth in character, so that he should lie down each night a better man. There is a daily personal growth in his power to do good, which should be at once a reward of past work, and a stimulus to better. There is a daily personal growth in the friendships and esteems of life, which constitute one of the most delightful rewards of the doctor. What greater joy can there be in life than to go about among one's fellow-men carrying with him, as the doctor does, an atmosphere of comfort, of hope, of courage, of health?

There come to him, constantly, cases in which disease challenges him to combat. It says to him, as it were, "Catch me if you can, in all my devious wanderings and unexpected disguises"; and there is a mental exhilaration in following every turn in the trail and running to earth the fleeing goblin that is captivating to every inquiring mind.

Look for a moment at the methods of the careful, intelligent doctor, as he investigates such a case. First, he inquires with care into the family history for lurking influences of evil heredity. Next, into the personal history, not only the physical history of the patient from his birth, but also the influences of his environment, his habits, his hours of rest, his methods of labor, his physical and mental virtues and vices. Then follows the history of his present illness, including all his symptoms, the examination of his secretions and excretions, the shrewd judgment which eliminates the unessential and often the inaccurate or imaginative statements from those which are real and essential. Then, too, he must not forget the influence of mental states; of worry; of family trouble; of personal trials. Next he passes to the physical examination of his patient, when his eye must be as keen as that of an eagle, his touch deft and delicate in estimating size, consistency, elasticity, and other physical conditions. He must then co-ordinate all the so far disjointed facts with a mental acumen and logical method which, at first laborious, becomes afterward comparatively easy if he has been faithful and thorough in his earlier investigations. By these means he reaches a diagnosis and settles definitely upon the medical or surgical treatment. Each case is then a study in physics, anatomy, physiology, pathology, psychology, chemistry, therapeutics. In the vast majority of cases he is rewarded by seeing returning health.

Sir Spencer Wells, as the net result of his first 1000 ovariotomies, added 20,000 years to human life, and so far has modern surgery surpassed this result that every thousand similar operations to-day add not less than 30,000 years to human life! Think what one of these lives means, as the pale cheek regains its color, the feeble pulse its force, strength succeeds weakness, each day records a gain, and finally health is re-established. The tender father returns to his usual pursuits; the adored mother once more becomes the center of loving care of her family; the beloved child is restored to the family circle with ruddy health, rescued from the valley of the shadow of death itself. The hushed voices, the soft tread of the sick-room have given place to the laughter of health, the mists of sorrow are driven away, the anxious alarms of disease have vanished. What, think you, can equal the joy of the physician, as he views this happy transformation? Who is a dearer, more cherished, more welcome friend than he? Who finds a warmer place by the fireside and in the very hearts of his patients? No one can adequately appreciate his profound joy, his daily delight, his deep gratitude to the "Giver of every good and perfect gift." Oh, my friends, it is a blessed profession, a divine calling, with a heavenly recompense on earth!

But sometimes death must come. Even here, however, the kind and sympathetic physician finds his place. Who can so tenderly guide the poor sufferer to his long rest, so gently assuage the pain of the dying? Who so endears himself to broken hearts in the hour of their bitter extremity as the strong, yet tender, Christian physician? Often even death makes for us our dearest, most loving friends, who would pass through fire and water for us.

Even its dangers are an attraction akin to those which draw the hardy mountaineer toward the dizzy heights of the Matterhorn. And when to these dangers is added, in times of pestilence, the clarion call of duty to his fellow-man, where has there been a recreant doctor? Point out the renegade if you can! The gallant Six Hundred who rode into the Valley of Death were no braver than the unsung heroes of Norfolk or of Hamburg. I glory in my profession that in such hours of peril it has known no cowards; the meanest soldier in its ranks has been a brave, unselfish, devoted hero, and oftentimes a faithful, gentle martyr dying at his post of duty.

But besides the economic and the philanthropic side, medicine has, thirdly, its splendid scientific aspect which fuses with both of the others, and yet may be regarded separately from them. Let me point out some of the best achievements and present problems of medicine. The present century has seen vast strides in every department of medicine. I will not weary you by mentioning the improvements made in many minor details which would be more suited to a technical audience, but it is proper that I should allude to three brilliant discoveries which stand out prominently as of the first magnitude.

First, the discovery of anæsthetics. The beneficent results from this discovery are so well known that I need only call attention to them and also note in passing that the three principal anæsthetics—ether, chloroform, and nitrous oxide—are American either by discovery or by introduction into general use.

The second great achievement is the antiseptic method by one of our cousins across the sea, the justly immortal Sir Joseph Lister. While anæsthetics have been an immense boon, especially in the domain of surgery, antiseptics have saved countless lives and untold suffering. The method is so recent that I have seen both its birth and its development. In our late war and for ten years after its close every wound and every operation was followed as a matter of course by fever and more or less suppuration, or the formation of "matter," which in a multitude of cases resulted in blood-poisoning, erysipelas, hospital gangrene, lockjaw, and a hundred other kindred evils from this Pandora's box. Now, however, we are enabled to perform any one of the ordinary operations—such as amputations, ligations of the great blood-vessels, the extirpation of tumors, and the like—with almost absolute safety, and this surgical safety has emboldened us to perform many operations undreamed of even by an Astley Cooper, a Nélaton, or a Pancoast. The great cavities of the body—the head, the abdomen, the pelvis, and even the chest—are invaded with a sense of security and an almost absolute certainty of recovery which would have astounded our fathers. Amputations which were formerly attended with a mortality of nearly fifty per cent. are now so free from danger that we always expect our patients to recover, and are chagrined if they do not. Compound fractures, which twenty years ago often had a mortality of over sixty per cent., now scarcely occasion any anxiety, and ovariotomy, formerly a most dangerous operation, the rise of which I can well remember, has now a mortality of only ten, five, and even three per cent.

The third great discovery of the century is the new science of Bacteriology, a child as yet in its teens. It arose when many of my younger auditors were discarding their knickerbockers for trousers. That minute organisms or germs were the cause of very many diseases had long been suspected. but until twelve years ago we were not at all certain that the process of inflammation and the formation of matter or pus, or that many well-known diseases were the result of such germs. Now we know not only that they are the cause of all inflammation, but scientific investigation has shown us that all suppuration, pneumonia, lockjaw, diphtheria, erysipelas, leprosy, tuberculosis, and a host of other diseases are due to these minute vegetable germs. You can easily understand that only the first elementary facts have been ascertained and by no means all of these. Here is a whole new science awaiting patient investigation and brilliant discovery. Who that has ambition and enthusiasm is not aroused by such a prospect?

How is it that these minute germs produce their malign influences? We know that they secrete or in some way produce certain deleterious poisons in the human body, but how these or the bacteria act we do not know. When we learn just how they act, in all probability we shall be able soon to discover the means of counteracting their harmful effects. The problem how to destroy the bacteria without destroying the patient is one which we have not yet solved. We know that they produce infection. We know fairly well how to prevent their entrance into the body in surgical cases by the careful antiseptic cleansing of the person of the patient, of the instruments, sponges, dressings, hands, everything which comes in contact with the wound. But in many instances cases are brought to us already infected. A man who has met with any accident has an infected wound, and if any time has elapsed his system has become infected. We are as yet groping for methods by which we can surely overcome such a previously established infection. Here, you see, is another field for scientific activity and the most beneficent results.

We are learning how to prevent typhoid fever, tuberculosis, and other medical diseases, but have not even yet begun to learn how to prevent the entrance into the system of the bacteria of pneumonia, influenza, and other similar diseases.

Again, there are certain half-discovered facts which already give us glimpses of unsuspected triumphs. Within the last few years it has been found by experiments on animals that the germs of certain diseases when inoculated, for instance in a rabbit, from that to a second, a third, and so on, become intensified in their action; whereas if similarly inoculated in one monkey after another they become diluted and weakened in their action. How or why does the virus or germ become stronger by transmission through a series of rabbits, and weaker in its transmission through monkeys? How can we utilize this for the benefit of humanity? Here is another problem awaiting its Newton or its Morse.

Again, we know that there are animals in which we cannot produce certain diseases. For instance, the attempt has been made scores of times to inoculate cancer into the lower animals, without success. They do not suffer from measles or scarlet fever, whooping-cough or mumps. There are also diseases peculiar to certain animals which man does not take. We know very well that there are some human diseases from which certain persons are exempt. For instance, people have grown up from childhood, been exposed to scarlet fever, or measles, or small-pox, and yet have not taken it. These animals or people have what we call a "natural immunity" to these diseases. Thus far preventive medicine has only attacked one disease in the way of producing an artificial or "acquired immunity." This is vaccination by which immunity against small-pox is produced; or, in other words, a vaccinated person can be exposed repeatedly even in epidemics of small-pox without contracting the disease. With such a striking example before us for over a century, how strange it is that it did not suggest experiments in the same direction in other diseases.

But at last this hint has been taken and it promises much in the future. For instance, it has been discovered that if we inoculate an animal with the germ of lockjaw, the most virulent of all bacteria, and then take the watery part of the animal's blood—the blood-serum—and inoculate another animal with it, the second animal may then be inoculated with the germ of lockjaw without becoming the victim of the disease; in other words, in the second animal there has been produced an acquired "immunity" against the disease, Even if the lockjaw had already attacked the second animal. this blood-serum, it was found, would vanquish the disease. Here we come to one of the most striking recent results of scientific investigation. Once that it had been tried sufficiently often to determine that this mode of conferring immunity or of arresting the disease was not deleterious to the animal, it was deemed right that the same attempt should be made in man to cure this dreadful disease, and within the last three or four years there have been recorded nearly a score of cases in which patients suffering from violent attacks of lockjaw have been cured by inoculation with the blood-serum from such an animal. This immunity or cure is supposed to come from some antidote, or, as it is called, "antitoxin," produced in the first inoculated animal and introduced into the body of the second animal or of man with the blood-serum. Think you that it will be no great service to humanity, no great scientific feat, which will fill one's mind with a wondering, never-ending satisfaction, and crown his life with fame, when this problem is fully solved? What extraordinary results it may lead to we can as yet only guess at, but its possibilities seem magnificent. At this very moment Dr. Haffkine is in India inoculating people with the antitoxin of cholera and bids fair to succeed in his efforts to limit or prevent this fearful plague.

You have all heard, of course, of Koch's tuberculin. This consists of a modification of the ptomaïnes or poisons produced by the little bacillus or germ which causes tuberculosis or consumption. You know how the discovery was prematurely announced and heralded by the newspapers and then fell into disuse, and has been the object both of obloquy and ridicule. As a matter of fact, it is still being used in other modified forms by physicians and surgeons, and it is not too much to say that we have gone a long way towards finding the means by which we shall probably cure consumption and all the other baleful effects which follow from tuberculosis. And when I tell you that there is not an organ in the body which is not affected by tuberculosis, and that it is the cause of far more suffering and more deaths than any other disease, you will appreciate the immense boon its cure will be.

And please note that these instances which I have given of lockjaw, of cholera and of consumption are but types of a series of investigations in the antitoxins or natural antidotes. This opens the door to a wholly new class of remedies furnished by our very foes, on which a large number of experiments are being constantly made.

The fearful ravages of cancer are familiar to all. Its cause is unknown, its cure compassed only by its early extirpation, and even then, I must regretfully confess, but rarely. But within the last year research has seemed to show that we are on the verge of the discovery of its cause, and if so, time will give us its cure.* Who of you would not rather make such a discovery than be the father of the Atlantic cable or the successful general of a great war? Who would be so blessed by future millions of mankind as the discoverer of such a boon to the whole race?

Within the last two years also another class of remedies has been introduced, especially in connection with a disease with which you are probably not familiar, known as myxœdema. You all doubtless are aware what goitre is. Until lately it was scarcely deemed amenable to operation, but modern surgical methods have so improved that several hundreds of cases have been reported in which the goitre has been removed, and the patients have nearly all recovered.† But

* Up to this time the cause of cancer has not been discovered, but its cure is no longer "rare"; about 50 per cent. of the cases are permanently cured by early and complete operations.—(W. W. K., 1905.)

† In the twelve years since this address was delivered many thousands of successful operations have been done. In 2000 cases the mortality reported by Kocher is less than 1 per cent.—(W. W. K., 1905.)

after these operations a curious and unexpected result was found. Goitre consists in the enlargement of a certain gland in the neck called the thyroid gland. If the whole of this gland either in health or disease is removed, a considerable proportion of such patients undergo a sort of elephantine growth all over the body. The features become thick and clumsy, the fingers and toes swell to twice their ordinary size. The mental condition also degenerates into a form of cretinism. This misfortune attending the complete removal of the gland led, first, to a modification of the operation,—viz., the partial instead of the total removal of the gland; even a little of the gland if left, it was found, would prevent such a bad result. But it has done more than this. Victor Horsley, in England, suggested that in cases in which, as sometimes occurs, this disease, myxœdema, arose spontaneously, the thyroid gland itself might be used as its best remedy.

Accordingly first it was used surgically. The thyroid gland was removed from a sheep and transplanted under the skin or into the abdominal cavity of the patient. It grew there, and so long as it remained the patient was bettered; but experience showed that the gland soon disappeared and the betterment vanished with it. Then an extract was prepared from the gland and used hypodermically. This gave still better results, but it was suggested again that if the patient were simply fed on the gland itself (it is one of the sweetbreads of the body) cure might follow; and within the past year a large number of cases have been reported which have been cured by this wholly new method of treatment. See, then, here another fruitful field of research in the administration of various remedies derived from particular glands or other structures in the animal body. Already such an extract from the brain has been used in epilepsy, but it is too early as yet to say whether the result will prove to be good or not. Within a month, Vaughn, of Ann Arbor, has also called attention to the fact that the extract of the thyroid and other glands is fatal to bacteria. This new discovery may lead to the most beneficial results.

But what we do not know in bacteriology is far, far greater than what we do know. The bacteria of scarlet fever, of measles, of small-pox, of whooping cough, of typhus fever, of hydrophobia, and of many other diseases are as yet unknown and awaiting your touch, your investigation. If you miss your chance, others will seize it.

If I were to ask any one of you whether Anatomy, Physiology, and Chemistry are comparatively complete sciences, I suppose you would answer unhesitatingly, yes. On the contrary, they are most incomplete. We know to a fair extent the gross anatomy of the human body, although even here there is an immense deal to be learned; but the minute anatomy is not well known, and there is scarcely an organ in the body whose physiology has been half studied. Even so common a substance as the white of an egg has defied the chemists, and the analysis of ninety-five per cent. of the solids of the body is imperfect. Yet this is fundamental Physiological Chemistry.

When I first taught anatomy, the great divisions of the brain into two hemispheres, the cerebrum, the cerebellum, etc., were, of course, known, but the various convolutions of the brain surface were deemed to be simply fortuitous by the anatomist, the physiologist, the physician, or the surgeon, and that one convolution had no more value than another. Investigations in the last twenty years have definitely mapped out the brain, showing that the convolutions and fissures are not arranged hap-hazard, but on a definite plan. A portion of the brain at the back of the head and a little at the side of the head are fairly well known, well enough, indeed, for the successful performance of extraordinary operations in diseases and injuries of the brain. But all the rest of the brain is as yet almost a *terra incognita*—an Africa standing expectant for its Stanley. Here again is another problem seeking solution, a problem which is enough to arouse the scientific ambition of any enthusiastic mind.

Again, it is only within the last five years that an accurate knowledge of the relation of diseases of the ear to diseases of the brain has been recognized, and their scientific surgical treatment begun. The splendid results already achieved give promise that within a few years we shall know not only how to cure brain disease the result of disease of the ear, but—what is far better—how to prevent it.

The anatomy of the nerves has been known for many years in its gross outlines, but the problems which present themselves here are many and varied. Cut a certain nerve, the ulnar, which supplies the inner part of the hand, and the results are not the same in all patients. You may abolish touch and yet pain will remain. You may even cut out one to three inches of the sensitive nerve of the face, as I have seen within the last few weeks in several cases, and it will be reproduced, and with this the frightful pain of tic douloureux, for which the nerve was removed, will return. On the other hand, by a wound or in an operation from one to three inches of a nerve may be removed, and you want the nerve to be reproduced and so re-establish sensation in the skin supplied by it and motion in the muscles to which it goes, and the nerve steadily refuses to reproduce itself. Why in the one case it will and why in the other case it will not reproduce itself we do not know. In fact, what we do not know about nerves alone would make a good-sized book.

Thirty years ago when we looked at an eye all we knew was what we could see on the outside. The trouble was that, although there was such an inviting window in front of it by which we could look in, nothing could be seen inside of the eye because the interior was totally dark. But it occurred to Helmholtz that if by a little bit of looking-glass he reflected light into the eye and then scratched a little hole in the quicksilver, he could look through the hole into the illuminated interior of the eye and see all there was inside of it. From this simple idea has arisen the ophthalmoscope, by which the whole medicine and surgery of the eye have been revolutionized, and great light has been also thrown on the diseases of the brain.

Again, when the mouth was opened, we could see certain parts, but the whole interior of the larynx and windpipe was beyond our sight, and therefore beyond our knowledge. But soon after the ophthalmoscope was discovered Czermak and Türck found that if a little mirror were held in the back of the throat at an angle of about 45 degrees and a ray of light were thrown upon it from a small perforated bit of looking-glass, the interior of the throat, like the interior of the eye, would be illuminated, and we could look through the little hole in the looking-glass and see the reflected image of the vocal chords and the whole of the larynx in the mirror.

Similar inventions await the ingenious investigator of the future for the examination of other cavities and organs of the body, and the day is not far distant when we shall be able, I hope, to see and therefore to know the interior of the stomach as well as we do the exterior of the body. That this will illuminate our own minds as well as the stomachs of our patients is certain.

And so I might go on in one department of medicine after another, presenting to you similar problems, some of them so technical that they would not be suited to a non-professional audience, and in each show you the vast need there is for bright minds. Has the last word been said in surgery, in medicine, in the diseases of any of the special organs of the body? Nay, verily we are but at the alphabet of investigation and of cure. Great as has been the progress in the last fifty years, greater I venture to say than in all previous time, I believe that the next fifty years will far eclipse the discoveries of the past fifty. Who could have predicted the rise of Bacteriology a score of years ago? And who will venture to say that in the next twenty years another science equally far-reaching, equally beneficent, equally brilliant in its achievements, may not arise? Even the present is a splendid time,

> "An age on ages telling
> To be living is sublime."

But the twentieth century in which you will live will be the most glorious time of all the ages. But you may take part in this grand march of progress, not only in the rank and file, but as a leader if you will but study and write. Or it may be, if you have the gift of imparting knowledge, you may be one of the teachers of medical science, an enviable post of honor and responsibility, but also of unequalled enjoyment.

Have I not put before you enough to arouse the ambition, the energy, the benevolence, the enthusiasm, of any young man about to choose his career? Can there be in any other department of human knowledge so fine a field for research, for discovery, for fame, and, what is far better, for serving the human race? If, in consequence of what I have said to you, some of you will select Medicine as your chosen pursuit, rest assured that if you will faithfully perform your duty, at the close of life you will have the pleasure of surveying a career which has been advantageous to yourselves, has been a means of doing good to your fellow-men, and I verily believe has approximated as near as possible to the Divine Life as is given to any man to do.

VIVISECTION AND BRAIN-SURGERY.*

TO "Harper's Magazine" for October, 1889, I contributed a paper in which I demonstrated the fact, and to some extent the causes, of the recent marvellous progress of surgery. In this, as in an earlier publication, I attributed it to a large extent to vivisection. Both publicly and privately my statements have been called in question.

The seven years which have elapsed since my first publication on this subject have demonstrated, far more than I even hoped or expected, the truth of what I then stated, and it would seem right that some of these demonstrated facts should be laid before the public. Moreover, the recent revival of the discussion of the subject before the Church Congress at Folkestone, England,† and at the recent meeting of the Humane Society in Philadelphia in October, 1892, makes it especially timely.

I shall omit many topics which would be suitable, such as the wonderful results of Pasteur's treatment of hydrophobia, the discoveries of bacteriology, the wholly new class of remedies which medicine owes to vivisection, such as the antidotes to lockjaw and several other diseases, derived from the blood of animals inoculated with the virus of these diseases—remedies to which we already owe astonishing cures. In the present paper I propose to limit myself to brain surgery alone, and to give a glimpse of what has been done up to the present time. I shall show especially that

* Reprinted from Harper's Magazine for June, 1893, by the kind permission of Messrs. Harper & Brothers.

† Church Times, October 14, 1892, p. 1021.

without the exact knowledge of the functions of the brain, derived almost wholly from experimentation upon animals, it would be simply impossible to do what has been accomplished. I shall not restrict myself to general assertions which may easily be denied, but I shall relate actual cases, with their definite results, and the authority for each case.

In order to understand modern progress in cerebral surgery it is necessary first to understand what has been achieved by experimentation upon the brain. When I was a student of medicine, thirty years ago, the brain was regarded as a single organ, and its various functions were not thought to have any especial localized centres of action.* When the brain acted it was thought that the whole of it acted, just as the liver or the stomach acts, as a whole. Now we know that, instead of the brain being a unit, it is really a very complex organ. Just as in the abdomen, besides the other organs in its interior, we have the stomach, the liver, the pancreas, and the bowel, each of which has its part in digestion, so correspondingly in the brain, besides the portions concerned in sight, smell, thought, etc., we have four adjacent portions which are concerned in motion. One produces motion of the face; another motion of the arm; a third, motion of the leg; and the fourth, motion of the trunk.

How, it may be asked, have these facts been determined? Has it not been by observing the effects of injuries and diseases in man? To a small extent, yes. But very, very rarely does disease or injury involve only one of these very limited regions of the brain; and the moment two or more of them are involved our inferences become confused and misleading. As a matter of fact which cannot be gainsaid, nine-tenths of our knowledge has been derived from exact experiment upon animals, and in this way: A monkey is

* The "bumps" or localized centres of phrenology were always discredited by the medical profession, and experiments upon animals and observation in man have entirely overthrown them.

etherized, a certain area of its brain is exposed, and an electrical current is applied. This stimulation of most portions of the brain is followed by no motion in any part of the body. These parts of the brain, therefore, have nothing to do with motion, but are the centres for general sensation (touch) or for certain special senses, as sight, hearing, etc., or for mental processes. But in one definite region of the brain, called the "motor area," the moment the brain is stimulated by the electrical current motion is produced. Moreover, it was soon found that stimulating different parts of this motor area produced motion in different parts of the body, and that this was not haphazard, but that stimulation of one part of it always produced motion in the arm, and in another part motion in the leg, etc. Thus have been mapped out the various portions of the motor area, as will be presently described in detail.

It is evident that by experiment upon animals the motor area can be more easily and more exactly determined than can those regions which are the seat of the faculties of smell, taste, sight, and hearing, the presence or absence of these senses in animals being difficult to determine with absolute accuracy. Still more is this true of the parts of the brain which have to do with mental processes. Yet disease and injury in man, if they alone could answer the questions what part of the brain has to do with motion, what part with sight, what part with the intellect, ought to have answered them long ago. No better evidence could be given of the superiority of experiment upon animals over observation of accident and disease in man in determining facts of this character than this, that those centres are best and most accurately known which can be determined by vivisection, and that those in which vivisection can aid us but little are still only vaguely located. Thus the motor area is positively and definitely located; that for sight approximately well; those for hearing, smell, and taste and general sensation (touch) are still uncertain, though guessed at. As to those for mental processes, except perhaps one which will be alluded to later, we are almost wholly in the dark. Moreover, disease and accident have made their cruel and rude experiments ever since the world began. But as a matter of fact the last fifteen years of experimentation have taught us more than the previous fifteen hundred years of careful observation and of postmortem examination.

Let me now briefly explain this "localization of function" in the brain, and then show its value and certitude by cases

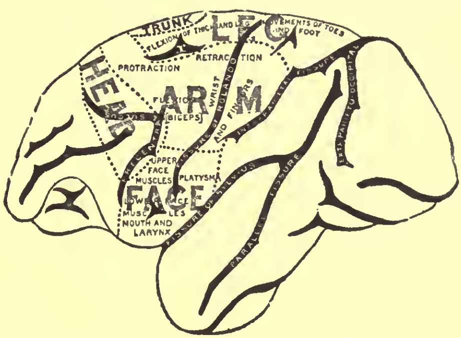


Fig. 1.—Side view of the surface of a monkey's brain, showing the location of the various fissures and of the motor centres. (Horsley and Schäfer.)

which arouse our interest not only by their illustrating the practical applications of science, but by the cheering and humane results in the relief of human suffering and the saving of human life.

Fig. 1 represents the motor area as ascertained by many experiments such as I have described upon the brains of monkeys. On its surface will be observed certain broad black lines labelled, from in front backward, "Precentral sulcus, Fissure of Rolando, Intraparietal fissure, External parieto-occipital fissure, Fissure of Sylvius, Parallel fissure," and others without names. In the middle, running downward and forward toward the left hand of the figure, notice especially the fissure of Rolando. This and the fissure of Sylvius are the most important fissures of the entire brain. The fissure of Rolando is, so to speak, the "axis" of the motor area of the brain. At its upper end will be observed the centre for the leg, with certain minor divisions marked in smaller letters. In its middle lies the arm centre; and it should be remarked that the part where the word "retraction" is is the shoulder centre, a little lower down is the elbow centre, and where "wrist and fingers" occurs is the hand centre. At the lower end of the fissure of Rolando lies the centre for the face, and at other points will be observed the centres for the trunk and head. By the word "centre" is meant that, for example, if you expose the part of the brain marked "arm," and apply the poles of an electric battery to that portion of the surface of the brain, you will produce muscular movement in the arm. If at the upper end, you will move the shoulder; at the middle, the elbow; lower down, you will move the hand, etc. This diagram shows the fissures and centres as ascertained in the brain of the monkey, but it must be remembered that they have an exact parallel in the human brain. The same fissure of Rolando exists there, the same fissure of Sylvius, the same intraparietal fissure, etc., as is seen in Figs. 3, 6, and 8, and the same centres for the arm, leg, trunk, and head. When I state that these exist in the human brain I am not stating what is theoretical, but that which, in common with scores of surgeons, I have verified in many cases in which I have exposed the human brain, applied the battery exactly at the places shown in this diagram of the monkey's brain (with such modifications as would follow the slightly altered relations of the same parts in the human brain as compared with the monkey's), and have obtained in man exactly the same resulting motions as have been thus experimentally determined in the monkey.

Naturally the first question that will occur will be, "This diagram shows the fissures and centres on the brain, but how are you going to tell from the outside of the head, without opening the skull, where they lie?" This has been determined by careful study of the human brain and skull, and their relations to each other. I will give only one illustration, and that by far the most important, namely, how we locate the fissure of Rolando, and therefore practically the whole motor area. Measure any head in the middle line, from a point between the eyebrows to that bony prominence which any one of my readers can feel at the back of the head just above the border of the hair. These points are called respectively the "glabella" and the "inion." Divide this distance into two equal parts, and thus obtain the mid-point between them. The fissure of Rolando starts half an inch behind this mid-point between the glabella and the inion, and runs downward and forward at an angle of 67 degrees. There have been constructed various simple and other complex apparatuses for the purpose of determining just this angle of 67 degrees, but it was reserved for Mr. Chiene, of Edinburgh, before the Congress of American Physicians and Surgeons in Washington, in September, 1891, to point out the simplest possible method of determining this angle, which any one of my readers can use. If a square of paper be folded diagonally, it is obvious that the right angle of 90 degrees at two of the corners is divided into two halves, or two angles of 45 degrees each. If the paper be then again folded so as to divide one of these angles of 45 degrees into two angles of 22.5 degrees each, it is evident that one angle of 45 degrees and another of 22.5 degrees make an angle of 67.5 degrees, which varies only half a degree from that of the

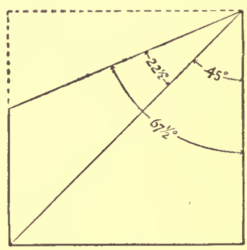


Fig. 2.—Prof. Chiene's method of finding the angle of the fissure of Rolando.

fissure of Rolando (Fig. 2). If the middle line of the head be marked with an aniline pencil on the shaven scalp, if its mid-point be then fixed, and if the strip of paper just described be so placed that its edge indicating the angle of 67.5 degrees runs downward and forward from a point half an inch back of the mid-point, the edge will correspond to the line of the fissure of Rolando, and can be marked by the aniline pencil on the scalp. If this line be measured for a distance of three and three-eighths inches from the middle line of the head, the length of the fissure of Rolando is also shown.

It is not necessary for me to go further into details. I purpose now, after having thus explained the "localization of function" in the brain, and the means of locating the motor area from the exterior, to show not only that, as a matter of fact, it has been verified in actual surgical experience, but also that it is so accurate that from the exterior of the head, without any scar or other evidence of injury (or even in the presence of an otherwise misleading scar), without any fracture of the skull, without any lump, prominence, or other means to guide us, cerebral localization is a reality, and as reliable as the needle of the compass itself to guide us exactly to the correct spot, so that we can open the head and expose the brain with an accuracy which is truly marvellous. If the last fifteen years of experimentation have done so much, what may we not expect in the next fifteen? Does not humanity as well as science protest against any hindrance to the further prosecution of work which has accomplished such results? Is this the work of "inhuman devils," as Canon Wilberforce has been pleased to term those engaged in it, or is it the work of humane men of science anxious to mitigate human suffering and prolong human life?

Now let us see what results practical surgery has given us by the application of the doctrines of cerebral localization of function to special cases otherwise beyond our power exactly to diagnosticate and to relieve. In each case I give the published authority, or, if the case has not yet been published, the records are accessible in the hospitals named. The cases are not of the time of John Hunter or of Sir Charles Bell, but of the last few years, and can be investigated and verified now.

The first case shows that it is possible not only to diagnosticate in general the fact that an abscess exists in the brain, but to locate it exactly, and to open it with the same precision as in opening an abscess on the hand. What is more to the point, in about one-half of such cases we can now cure the patients, who before vivisection had taught us modern cerebral localization would all have gone to their graves.

Case I. Abscess in the Brain.—In the "British Medical Journal" of April 21, 1888, Mr. Damer Harrisson records the following case: A boy, aged fifteen, had received a blow on the *right* side of his head from a pair of tongs eight days before his admission to the hospital. Three days after the accident a convulsion suddenly set in, involving the *right* side of the body, beginning in the arm and spreading to the leg and face, and followed rapidly in four days by eight other convulsions and paralysis of the entire right side of the body. Most of my readers would unhesitatingly attribute the convulsions and the paralysis to this blow from the tongs. But it must be remembered that the right side of the brain supplies the *left* side of the body, and vice versa. Hence Mr. Harrisson suspected that the paralysis of the right side of the body indicated trouble in the *left* half of the brain. Examining his head, he found on the left side a small scar at the junction of the arm and leg centres. Inquiry elicited the fact that, ten years before, he had received a severe blow there, which, however, had not been followed by any serious symptoms. Could this old injury, after so long a time as ten years, possibly be the cause of his present serious trouble? Further inquiry brought out the fact that for about a year before his admission the boy had had repeated twitching of his right arm. So convinced was Mr. Harrisson that modern cerebral localization was right that he opened the boy's skull, not where most people would suppose would be natural,—namely, on the right side of the head, where he had received the blow from the pair of tongs eight days before,—but on the left side, at the site of the blow ten years before, and at a definite point,—namely, over the fissure of Rolando,—at the place corresponding to the motor centre for the arm as established by experiments on animals. Although the first injury was received so long before, yet the paralysis showed that it was the left side of the brain that was involved, and the twitching of the arm showed that this was the particular part of the left side of the brain where the injury probably existed. Mr. Harrisson punctured what seemed on the surface to be a normal brain, and opened an abscess, and this boy, otherwise absolutely doomed to death, made an uninterrupted recovery. This is only one instance out of probably more than one hundred and fifty cases of abscess in the brain which have been reported within the last seven or eight years which have been diagnosticated with the same accuracy and by the same means.

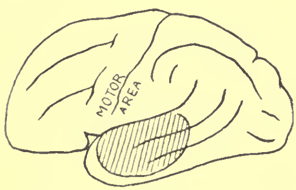


Fig. 3.—Side view of the human brain. The shaded area shows the location of the abscess producing pressure on the lower part of the motor area. (See Fig. 1.)

Case II.—In the "British Medical Journal" for August 11, 1888, Dr. Macewen, of Glasgow, relates the case of a patient who, among other symptoms of abscess of the brain, had partial paralysis of the right side of the face and right arm, and paralysis of the nerve supplying the left eyeball. For reasons stated in the paper he concluded, with great acuteness of reasoning, that the abscess could not be *in* the motor area for the face and arm on the left side of the brain, but in the projecting part of the brain just *below* these centres, but producing pressure upon them (Fig. 3). He confidently operated at this precise spot, and opened an abscess in the inside of the brain in the exact position described, and gave exit to *six tablespoonfuls* of pus, when the symptoms vanished, and in three weeks the patient was well!

Case III. Brain Tumors.—Nothing could be easier than to locate a tumor of the brain which showed itself externally. In a case in which the tumor is as large as that shown in Fig. 4 (which is the natural size of a tumor removed from a man who is still living, six years after the operation*) it might be

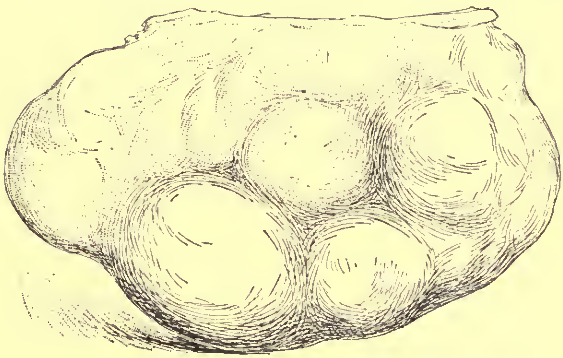


Fig. 4.—Natural size of a tumor removed from the brain. The patient is living after six years.*

thought easy to locate it, though, as a matter of fact, it is very difficult, owing to the large area of brain involved. But when I say that the existence of a tumor about the size of the end of the forefinger can be diagnosticated, and that before touching the head it should be said (and I was present when the statement was made) that it was a small tumor, that it did not lie on the surface of the brain, but a little underneath it, and that it lay partly under the centre for the face and partly under that for the arm in the left side of the

* This patient is still living, eighteen years after the operation.—(W. W. K., 1905.)

brain, and that the man was operated on, and the tumor found exactly where it was believed to be, with perfect recovery of the patient, it is something which ten years ago would have been deemed the art of a magician rather than the cold precision of science.

In the "American Journal of the Medical Sciences" for July, 1888, this case is detailed by Drs. Seguin and Weir, as follows: A gentleman, thirty-nine years of age, had been perfectly healthy until August, 1882, when he had malarial fever, accompanied with a good deal of pain. One day, as he arose to go to the window, his wife noticed a spasm of the right cheek and neck, which did not involve the arm, nor was consciousness lost. In 1886, two or three similar attacks having occurred in the interval, he fell, unconscious, and bit his tongue. These attacks were all accompanied with twitching of the right arm and hand and right side of the face. His memory became impaired and his speech thick. No injury had ever been received on his head, nor was anything abnormal observed even when his head was shaved. Gradually his right hand and arm became weak, and, as a result, his handwriting became bad. This weakness of the right arm slowly increased, and along with it a weakness of the right leg, and as a consequence of the increasing paralysis of his face, drooling at the right side of the mouth set in.

Dr. Weir examined him at Dr. Seguin's request, and both of them reached a diagnosis, chiefly based upon the facts already given, that the man had a small tumor situated as above described, and on November 17, 1887, the skull was opened at the junction of the arm and face centres. This operation I had the pleasure of witnessing personally. Nothing abnormal was seen on the surface of the brain. Yet so confident was Dr. Weir of the correctness of the diagnosis that he boldly cut into the brain substance, and from its interior removed a tumor of the size indicated by means of a small surgical spoon. The man made a perfect recovery. When examined microscopically, the tumor was found to be of a malignant character. It returned in about four years, and finally destroyed his life. Fig. 5 shows the tumor represented as a little ball in the substance of the brain.

In one sense, as a surgical feat, the removal of a tumor as large as that shown in Fig. 4 is a much more difficult and extraordinary operation (and one nearly twice as large, weighing over half a pound, has lately been successfully removed by Bramann!); but as a matter of diagnosis and of surgical skill, locating and removing so small a tumor from the brain so successfully, and without the slightest indication on the exterior to guide one, is a much more brilliant and remarkable operation.

Fig. 5.—A cross section of the brain (only a part of the left side is shown). The round shaded spot represents the brain tumor. (Seguin and Weir.)

In the address which I published in 1885 I alluded to the first and then the only case known of removal of a brain tumor, and said: "By these experiments and operations a wide door is opened to surgery in the treatment of diseases within the skull, diseases heretofore so obscure and uncertain that we have hardly dared to attack them. The question is not whether death or recovery followed in this particular case. The great, the startling, the encouraging fact is that with this experience we can now, with well-nigh absolute certainty, diagnosticate the existence of, and with the greatest accuracy locate, such diseases, and therefore reach them by operation, and treat them successfully." That my prophesy has been verified, let me quote the statistics gathered by Dr. Knapp, of Boston, in 1891. He collected 46 cases of operations for tumors of the brain, operated on in the last six years, of which 30 recovered(!), 15 died, and the result was unknown in 1. It must be remembered that these 30 which recovered would every one of them have died had not vivisection given us the means of accurately locating the disease. That we have not yet reached the accuracy which is to be desired is shown by the fact that in 15 other cases no tumor was found at the point of operation, and, of these, 13 died. Most of these tumors lay not in the motor region of the brain, but in other parts of it, in which our means of diagnosis are as yet very imperfect for the very reason that vivisection has thrown but little light on the function of these regions. There were also 4 cases of tumors which were found, but were so large as to be irremovable, and, of these, 3 died. To these statistics I can add 3 other cases. In 1 of these the tumor was not rightly located (it was not in the motor region), and therefore was not found at the operation, and the patient died. In the other 2 cases the tumor was found, but was irremovable. One patient died, and the other recovered from the operation, but died from the disease four months afterwards. He had, however, been relieved from the atrocious headaches which rendered life a burden, and his delusional insanity had almost wholly disappeared—results which fully justified the operation by the comfort of his few remaining days. (Another remarkable case, in which a growth of the under surface of the bone pressing on the arm centre was exactly located and successfully removed, is related by Dr. A. B. Shaw, of St. Louis, in the "American Journal of the Medical Sciences," December, 1892, p. 691.*)

Case IV. Hæmorrhage Inside the Skull.—Let me next give a case of a different character, but equally accurate and astonishing. An artery about as thick as the lead in an or-

* For later statistics as to brain tumors, see foot note on p. 81.

dinary lead-pencil runs in the membranes of the brain on the inside of the skull, in the region called "the temple," and grooves the bones quite deeply. In some cases in which a heavy blow is received on the surface of the skull, without fracture, or it may be even without leaving any mark whatever on the skull, this artery is ruptured, and a large amount of blood is poured out on the surface of the brain. Formerly it was not only almost impossible to make a diagnosis of such an injury, but, even if the rupture of the artery was suspected, before antiseptic surgery (itself the child of vivisection) arose, such patients were only treated with a little opium, rest, and regulated diet. Most of them died, but occasionally one got well. Of 147 cases collected by Wiesmann which were *not* operated on, 131, or over 89 per cent., died. The symptoms of such an injury are fairly clear, but, until the doctrines of cerebral localization were accepted, were often misleading. The patient is stunned by the blow, but usually recovers consciousness, only to relapse again into unconsciousness when the amount of blood poured out is sufficient to compress the brain, this compression of the brain producing also paralysis. Generally the artery on the same side of the head as the blow is ruptured, and the paralysis will be on the opposite side of the body. But sometimes, instead of the artery's being ruptured on the same side as the blow, it will be ruptured on the opposite side; or, again, if the blow be in the middle line, as in a case recently under my care, it may be difficult to tell which side has been involved. Moreover, as the artery splits into two branches, one of which runs in the direction of the motor region and the other back of it, it may be difficult to know where to open the skull in order to reach it. Now it is very evident that if we make an incision into the forearm to reach an abscess or a tumor, and it is found that the trouble lies one or two inches further up or down, the incision can be easily prolonged in the right direction, and will heal readily. But in the skull our diagnosis must be correctly located within a very small limit of error, for it is evident that we cannot enlarge the opening in the bone at will to almost any extent, as we can in the flesh. Wiesmann has also collected 110 cases which *were* thus operated on, of whom 36 died, or only 33 per cent.! What a contrast to the 89 per cent. of deaths when no operation was performed! In the majority of these 36 who died the clot was not found, and was therefore not removed, because in the earlier days we lacked the boldness and therefore the exactness of modern times.

Let me now give the case furnished me by Dr. Dench, by permission of Dr. Bull, of New York ("Buck's Reference Hand-book of the Medical Sciences," vol. viii, p. 227). A young man had been shot in the head, the ball entering above the ear, two and a half inches to the left of the middle line of the head. When first seen his right arm was paralyzed, and shortly afterward the paralysis had extended to the right leg and face. A diagnosis was made of hæmorrhage from one of the arteries of the brain, by reason of the fact that the paralysis had extended so rapidly from the arm centre to the leg and face centres, for no other cause excepting hæmorrhage could be so rapidly progressive. The wound was exposed, and a considerable clot gushed out, when motion immediately returned in the leg. The bone was then trephined, not at the bullet opening, but a quarter of an inch below and in front of the wound, when this bleeding meningeal artery was exposed and tied. It was found that a large branch of an artery in the brain itself had also been severed. This was tied, and in two months the man was well, no fever following, and no "matter" having formed. He could speak perfectly well, and could use his arm, but not his hand. The ball was never found.

Case V.—It may be objected that in the preceding case there was a wound to point out exactly the situation of the injury. Let me therefore give a somewhat similar case in which no such guide existed: M. Michaux ("Medical News," May 2, 1891, p. 504, from "Revue de Chirurgie," 1891, vol. xi, p. 376) reports a case of trephining, for serious meningeal hæmorrhage, probably of spontaneous origin, followed by cure. A man was brought to the hospital in a state of complete apoplexy, with paralysis of the left face and right arm. There was no sign of fracture or other injury. During the next few days the paralysis extended to the right leg. Epileptic convulsions set in, at first limited to the paralyzed regions, then becoming general. Occurring at intervals in the beginning, they became continuous at the end of three or four days. The patient was addicted to absinthe, and his head had troubled him for several months. The trephine was applied over the fissure of Rolando on the left side, over the "motor area" for the arm and leg, and an opening six centimetres long was made, through which the membranes of the brain were incised. This was followed immediately by the escape of four tablespoonfuls of large, blackish clots. After the operation the patient improved rapidly, and in a month most of the symptoms had disappeared.

Drs. Bremer and Carson, of St. Louis ("American Journal of the Medical Sciences," February, 1892, p. 134), and Drs. Homans and Walton, of Boston ("Boston Medical and Surgical Journal," February 12, 1891), have published cases in which, also without external signs, such clots have been accurately located and removed with success. In the latter case there was evidence of an injury, but the clot was on the opposite side of the head.

Case VI. Mental Disorders.—I shall now add a case involving the centres for mental processes, in the establishment of which vivisection has done but little, for reasons already explained, but a case of great interest and value.

If the reader will look at Fig. 1, and will find the fissure of Sylvius and follow it to its upper end, he will see that this end terminates in a ʌ-shaped convolution between the intraparietal and the external parieto-occipital fissures. In this portion of the brain have been located certain mental processes, including the ability to recognize objects and their uses. The location of this convolution of the brain can be made with almost the same accuracy as that of the fissure of Rolando.

The following case of Macewen, of Glasgow ("British Medical Journal," August 11, 1888, p. 306), will illustrate the accuracy of this localization. A year before Dr. Macewen saw him the patient had received an injury which had resulted in melancholia. Though formerly a happy husband and father, he now repeatedly contemplated the murder of his wife and children. There were no phenomena connected with motion in any part of the body by which the injury could be located; but it was discovered by that careful, close investigation for which this surgeon is so well known that, immediately after the accident, for two weeks he had suffered from what is called "psychical blindness," or "mind-blindness"; that is to say, his physical sight was not at all affected, but his mind was not able to interpret what he saw. I presume he was a stanch Scotch Presbyterian. He knew that, as was customary, his New Testament was lying by his side, but when he looked at it he was utterly unable to recognize it. While, however, his mental sight was thus affected, his sense of touch was perfect, and when he passed his hand over the smooth leather cover of his well-known book and felt the deep-indented letters on the back he recognized it as his familiar friend; but when he opened it, the printed words were unknown symbols to him. This gave to Macewen the key to the injury. He located on

Fig. 6.—Side view of the human brain. The shaded area shows where the bone pressed on the ʌ-shaped angular gyrus. (Macewen.)

the outside of the skull this ʌ-shaped convolution (Fig. 6, shaded area), known as the "angular gyrus," and found, on removing a button of bone, that a portion of the inner layer of the bone had become detached and was pressing on the brain, one corner of it being embedded in the brain substance. The button of bone was removed from the brain, and, after removing the splinter, was replaced in its proper position. The man got well, and, although still excitable, lost entirely his homicidal tendencies and returned to work.

Case VII. Epilepsy.—If I were to gather together the operations which have been done for epilepsy since we have been able to locate the centres, especially for motion, I should perhaps have to record 150 cases or more. The great majority of these patients have recovered from the operation, or, in surgical parlance, have made an "operative recovery," but in a very large proportion the disease has returned, generally, however, with a lessened intensity. In a small proportion recovery has taken place from the disease itself. But it is evident that as cerebral surgery covers practically only the last eight or ten years, it is much too early to formulate definitely a statement of what the results may be when a longer time has elapsed.

In the "American Journal of the Medical Sciences" for December, 1891, Dr. Charles K. Mills, of Philadelphia, has reported the case of a young lady twenty-seven years of age, who suffered for some time from numbness and a sense of weight in the left hand, arm, and foot. After about five years these attacks developed into distinct epileptic fits, and had become extremely frequent at the time when Dr. Mills first saw her, in November, 1890. The attacks occurred both in the daytime and at night, and were as frequent as ten to fifteen in the twenty-four hours. Dr. Mills himself often saw them. The left arm was first raised, the motion beginning in the shoulder and including also the elbow. From this the attack extended over the entire body. On the outside of the head, after it had been shaved, absolutely nothing was found which could be a guide to the site of the trouble. The diagnosis was some source of irritation the character of which was unknown, but which was located on or in the centre for the left shoulder. Accordingly the fissure of Rolando was mapped out on the shaven head, and a button of bone an inch and a half in diameter was removed, the centre of which was an inch and three-quarters to the right of the middle line. Fig. 7 shows the button of bone, the inner surface being uppermost. The bone was very thick, from five to seven-sixteenths of an inch, and was also very dense. As soon as the bone was removed, a small tumor resembling in shape a minute bunch of grapes was found, the apex of the tumor being within *one-sixteenth of an inch of the point where it was believed to exist.* By its pressure it had produced several pits on the inner surface of the bone, and these holes, as well as the groove for a large blood-vessel which supplied the tumor with blood, are well shown in the middle of the button. The tumor, with the membrane of the brain to which it was attached, was removed, and the battery was then applied to the brain immediately underneath it. Fig. 8 shows the fissure of Rolando as a line running downward and forward across the circle. The circle represents the button of bone removed, and the numbers 1 to 4 represent the points at which the poles of the battery were applied to the brain. On stimulating the brain at the point marked 1, movements of the arm at the shoulder and elbow were reproduced; and

Fig. 7.—The button of bone removed in Case VII. The pits in the bone were produced by the tumor. They were almost precisely in the centre of the button, and thus show how exactly the tumor was located. (Mills.)

again at point 2 precisely the movements of her attacks followed. This point was the portion of the brain pressed upon by the tumor. Along with the movements of the shoulder at point 1 the elbow was involved, and at point 2 it was found that the hip and knee were both flexed, and the entire leg carried away from its fellow, the toes and foot being extended. It was very evident, then, that point 1 corresponded to the shoulder and elbow centres, and point 2 corresponded to the upper edge of the shoulder centre and also to the edge of the leg centre. Excitation at point 3 was followed by more de-

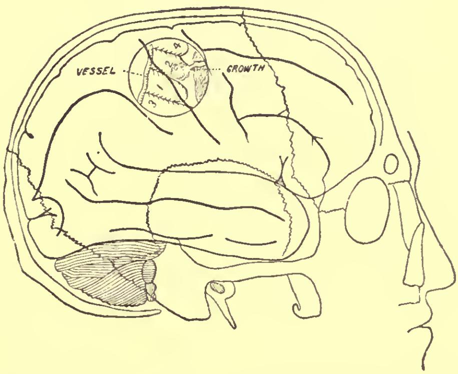


Fig. 8.—The brain in Case VII. The circle shows where the button of bone was removed, and the growth found almost exactly at the centre of the button. (Mills.)

cided movements of the lower arm, and at point 4 the leg alone moved, the shoulder not being involved.

Could any better illustration be found of the accuracy of localization? The leg centre here, when compared with the leg centre in Fig. 1 of the monkey's brain, is found exactly where it ought to be, the arm centre directly below it, with the shoulder, elbow, wrist, and hand movements precisely in the same relative positions as in the monkey's brain. Unfortunately the lady has not been cured. But the fits have been greatly moderated, so that when the case was reported, nearly a year after the operation, she had usually only about three attacks in the twenty-four hours instead of ten or fifteen, and the attacks had never attained the same severity as before the operation. Moreover, after the operation, in about half the attacks she did not lose consciousness, and so was far less exposed to the danger of falling down stairs, into the fire, and other similar perils to which epilepsy with unconsciousness exposes a patient.

Case VIII.—Another case, which is fortunately more favorable in its result, is published in the "Medical News" of April 12, 1890. A little boy, six and a half years old, at the age of fourteen months fell about ten or twelve feet from a hay-mow upon a plank flooring. He was unconscious for some time. No decisive evidence of injury could be found either on his head or other parts of his body, but from his prolonged unconsciousness it was presumed that he had struck his head. Soon after this accident his disposition changed materially for the worse. He became irritable, obstinate, and ill tempered, and very frequently kicked, bit, and scratched, and offered other violence to his playmates. His room had to be padded, his clothes had to be sewed on him every morning, and he would kill any small animals, such as cats or chickens, that came in his way. When two and a half years old his first epileptic fit occurred. He had from three to six attacks a day, with some intervals of comparative freedom. His father, an intelligent clergyman, estimated that in the four years since his epilepsy began he had had over five thousand fits! Of these, about eighty per cent. began in the right hand. The attacks were observed with great care in the Jefferson Medical College Hospital by a special nurse, and the statement of his father that they usually began in the right hand was verified. When the attacks began the child had a vocabulary of about forty words, but gradually these were reduced, word by word, until his speech consisted only of three words and a little jargon, the words being "papa," "mamma," and, characteristically "no," rather than "yes." Examination of the head revealed nothing that could locate any injury; but as the attacks began so constantly in the right hand, it was resolved to remove the centre for this part of the body, in the hope that if the fits were prevented at their initial spot they would not begin elsewhere. The fissure of Rolando was first located, then the position of the hand centre was marked, and a disk of bone an inch and a half in diameter was removed. The membranes of the brain were then opened, and the brain itself exposed. Nothing abnormal was perceptible either by eye or by touch. The battery was applied to the portion of the brain exposed, producing movements of the hand, showing that the centre had been correctly mapped from the outside of the skull. Excitation of the brain further upwards produced elbow movements (elbow centre). These centres were therefore exactly where they ought to lie, as shown in the monkey's brain (Fig. 1). The portion of the brain that moved the hand was then removed, and when the battery was applied to the parts around it, it was found that all the centre for the hand and wrist had been removed.

The boy made a speedy recovery from the operation. Three years have now elapsed since the operation. Most of the time he has been and still is in Misses Bancroft and Cox's School for Feeble-minded Children, at Haddonfield, New Jersey. He has had there very painstaking care, and to this is to be attributed very much of his mental improvement. During the last six months of 1892 he has had only one attack for about every sixty before the operation. This improvement can be attributed only to the good effects of the operation.

Case IX.—The third and last case to which I shall refer has not been published, but can be found in the records of the Orthopædic Hospital and Infirmary for Nervous Diseases in Philadelphia, Record Book S. 9, p. 123. A young girl of about twenty-one was admitted to the infirmary in October, 1891. She said that her attacks of epilepsy, from which she had suffered for two years and a half, always began in the right thumb. This fact having been verified, it was decided to remove the centre for the thumb, for the same reason as in the last case,—i. e., to stop the very beginning of the fit. It was especially desired to remove only the centre for the thumb, and not that for the hand, in order not to interfere more than was necessary with the usefulness of her hand, upon which she depended for her support, as she was a mill girl. This was an unusual and minute attempt at localization, and a very severe test of the accuracy of the mapping of the brain by vivisection. On October 6, 1891, the fissure of Rolando was first located, and a disk of bone an inch and a half in diameter was removed, the centre of it being two and five-eighths inches to the left of the middle line. Both the bone and the brain, when exposed, seemed to be normal. The fissure of Rolando was seen crossing the middle of the opening, downwards and forwards (Fig. 9). By the battery the brain was stimulated at certain definite points until the thumb centre was recognized, and also the face centre, which lay somewhat below it, and the wrist centre, which lay —as shown by experiments on the monkey's brain—a little above it. Each of these centres was recognized by the movement of the part supplied by it (thumb, face, wrist) when the centre was touched by the poles of the battery. Stimulation of the thumb centre produced a typical epileptic fit, such as she had suffered since her admission, beginning in the thumb,

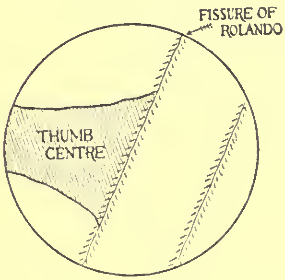


Fig. 9.—The circle represents the opening in the skull disclosing the thumb centre almost at its middle. The shaded area represents the part of the brain which was removed.

as she had asserted. The portion of brain corresponding to the thumb centre, a piece about half an inch in diameter, was removed, and by the battery it was determined that the portion removed was the whole of the thumb centre. She recovered promptly and without disturbance from the operation.

It was necessary in this case to be unusually accurate, and not to remove any portion of the brain other than the centre for the thumb, and for three reasons: First, if too much were removed upwards and backwards, the wrist and fingers would be paralyzed; second, if too much were removed forwards, the muscles of the face would be involved; third, a little further down lies the centre for speech, and had this part of the brain been injured, this important faculty would have been destroyed, thus producing serious and unnecessary trouble.

Note now the accuracy of experimental cerebral localization. As soon as the patient had recovered from the ether and was in a suitable condition, her ability to move the face and hand was tested. All the muscles of the face were entirely intact, and could be moved with absolute ease. Her speech also was unaffected. She had absolute and perfect control of all the muscles of the shoulder, elbow, wrist, and hand, *with the single exception of the muscles of the thumb, every one of which was paralyzed.* In order to understand how curious this paralysis is in relation to the thumb centre in the brain, the reader must observe that only a small piece of the brain, half an inch square, was removed, whereas the muscles of the thumb lie as follows: some of them in the ball of the thumb on the hand, one between the thumb and forefinger, one on the front of the forearm reaching almost to the elbow (the great flexor of the last joint of the thumb), and three of them on the back of the forearm, extending halfway from the wrist to the elbow; and yet the removal of so small a portion of the brain paralyzed these muscles of both widely different situation and widely differing functions (flexion, extension, abduction, adduction, and circumduction).

By June, 1892, she had entirely recovered the strength of her thumb, as shown by the dynamometer, both sides then registering the same number of degrees.

This history illustrates one of the most curious problems of cerebral surgery. The removal of any portion of the motor region of the brain is, of course, followed by palsy of the part of the body supplied by that brain centre; but though I have frequently removed portions of the brain, I have never yet seen this paralysis permanent. I have seen a right hand wholly paralyzed after such an operation, and in three months it had regained its strength and dexterity sufficiently to enable its owner to play baseball. But while this is true of the careful removal of small parts of the brain by operation, the wide-spread injuries which result from accident are not seldom followed by extensive palsies which remain throughout life. In the case just related not only has strength returned equally, but such delicate movements as are involved in the use of a needle have been preserved, or rather restored. Usually, however, weakness, to a greater or less extent, will remain in the part of the body controlled by the portion of brain removed. Whether there is actual reproduction of brain tissue or not is as yet uncertain, because after such operations there have been almost no deaths at a period sufficiently remote to enable us by post-mortem examination to determine whether such a reproduction has occurred or not. It is possible that the similar centre on the opposite side of the head is capable of doing double duty; for although normally the right side of the brain controls and moves the left side of the body, and *vice versa*, yet apparently there is a latent power which when necessary is called into play, and enables the right side of the brain to innervate and control the same side of the body as well as the opposite side, just as, for instance, the left hand, which is unused to writing, can acquire the faculty of writing if the right hand loses it.

There has also been performed a very remarkable operation on animals which may hereafter produce important results. Several experimenters have opened the heads of two dogs (both under an anæsthetic, and both as carefully and as tenderly cared for as any human being could be, the operations being attended with but little pain,* as they were done with the most careful antiseptic precautions), have taken a bit of the brain from the head of each dog and transferred it to that of the other dog. The pieces so transferred have grown in place, and have caused at least no mischief. Whether it will ever be possible to transfer brain tissue from the lower animals to man, and whether if so transferred it will properly perform its function, are problems as yet unsolved. It would be, I think, unwise to test its effects in man except as applied only to the motor regions at first, for we have every reason to believe that the motor cells in an animal's brain subserve precisely the same function as the motor cells in the human brain. Moreover, nothing of this kind would ever be done excepting perhaps in case of an accident where a considerable portion of the human brain was destroyed, when possibly this loss could be made good from an animal's brain. It is unnecessary, however, to discuss this question at present, for all the facts in the case, the needful precautions to be taken, and all the possible results, must first be determined in much greater detail and by much larger experimentation on animals than has yet been done before it will ever be considered in man. But it is not at all impossible that in this way we may see hereafter one of the most brilliant achievements of modern cerebral surgery.

* Most operations on the brain are followed by very little pain, and sometimes it may truthfully be said by none. It is not an uncommon result for the patient to take no medicine, or at most a single small dose of an anodyne on the first day, be out of bed in three to five days, and entirely well in a week or ten days.

But we must return again to our last patient, for her subsequent history as to her epilepsy is quite as interesting as, and to her no doubt even more important than, the condition of her thumb. On December 17, 1891, seven weeks after the operation, she had one slight attack. January 13 and 30, 1892, there were two; then she had none until March 12th; another very slight one came on May 19th; and the last to date were two on July 8th (a slight one) and 10th, making in all seven attacks in eight months. The intervals, therefore, were growing longer, and the attacks, as a rule, were less severe, while before the operation the attacks were growing more severe and far more frequent, for at the time she entered the infirmary they were tending to become daily.*

The antivivisectionists constantly parade the few physicians who are in accord with their views, and by frequent reappearances make an apparent army upon the stage. As a matter of fact, Mr. Lawson Tait is the only one who has an international reputation; the rest are but little known. Even Mr. Tait recently changed his views, and in a speech in favor of the objects of the British Institute of Preventive Medicine, which are largely attained through vivisection, has declared that "bacteriological experiments on animals had proved of great value." What the real opinion of the medical profession of Great Britain is as to the value of vivisection is seen by the following resolution, which was passed in August, 1892, at the Nottingham meeting of the British Medical Association, and passed unanimously. The weight of such an authority can be best measured when I state that it is the largest and most important association of physicians in the world, and numbers over 15,000 members, including most of the distinguished men of the profession in Great Britain.

* Since this was written her attacks have become somewhat more frequent, but are still far less frequent and severe than before the operation.

"*Resolved,* That this general meeting of the British Medical Association records its opinion that the results of experiments on living animals have been of inestimable service to man and to the lower animals, and that the continuance and extension of such investigations is essential to the progress of knowledge, the relief of suffering, and the saving of life."

I have thought it worth while not to content myself with broad assertions that experimentation on animals has enabled us to locate with absolute accuracy the various motor functions and to some extent the other functions of the brain; but to any doubting Thomas I would simply say: See any brain operation of this character, and you cannot fail to be convinced of its humanity and propriety.

MEDICAL EDUCATION.*

Mr. President and Gentlemen of the Harvard Medical Alumni Association:

I ONLY wish that, in accordance with your President's introduction, I could rise to a height of a great argument; but I must be satisfied as nature built me. I am very glad, I assure you, to bring to you the greeting of your Philadelphia brethren. The marble doorsteps of Chestnut Street, so celebrated by Dickens, greet the gilded dome on Beacon Hill, where the descendants of the Pilgrims and the Puritans "live and move and have their beans." It is well known that all of the streets grow grass in profusion; and Philadelphia sometimes, by a sepulchral description, is said to be a well "laid out" city. But I assure you that, when we get together such lively corpses as Mitchell and Wood and Pepper and Hare and Goodell and Wilson and Montgomery, we have a very good time.

Your President was kind enough, in his note asking me to be present on this happy occasion, to propose that I should speak on the subject of Medical Education. It is possibly a well-worn theme, especially before you, who have such elaborate reports, and I am glad to say such encouraging reports, from year to year of the progress of this great School; but there are still some points of value, it seems to me, which we can consider here. I remember very well indeed, in the days of the elder Gross, hearing *ad nauseam* of medical educa-

* An address delivered at the Dinner of the Harvard Medical Alumni Association, June 26, 1894. Reprinted from the Bulletin of the Harvard Medical Alumni Association, June, 1894.

tion and the progress that we ought to make,—bushels of talk and thimblefuls of action; but, after all, when you consider it, these discussions, though they led at that time to very meagre action, were not without their results, and great results, too. They were slowly leavening the whole lump of the profession. They gradually made the profession the support of all the progress that we have seen; and I am sure that the medical schools, even, I believe, Harvard University itself, would never have taken the remarkable steps in advance which the last few years have witnessed, had it not been for that very constant talk, that very constant working of the leaven throughout the profession. I trust the profession. I trust them profoundly. They have ever been better in that respect than the schools till of late.

There has been certainly a remarkable wave of progress passing over this country in the matter of medical education in the last few years. It has been demonstrated, first of all, by the creation of State Boards of Health, and especially by the noble Illinois State Board of Health, a body which has done more for medical education than any other, I believe, in this country, because it fixed an advanced standard. These boards now have been established in almost all the States; and they have been followed by a still more notable advance,—namely, the establishment of State Boards of Medical Examiners, wholly independent, as they ought to be, of the medical schools themselves. Again, another very remarkable indication is that our universities and colleges all over the land are establishing distinct courses leading up to those of the various professional schools, medicine among them. And what does this mean but that the medical schools want better men, and that the colleges are going to furnish them? In addition to this, another important indication in the same direction, which Dr. Langmaid has just alluded to is the establishment for the first time of a section of Medical Pedagogics in connection with the Pan-American Medical

Congress. I hailed with great delight another similar indication in the programme of the American Surgical Association last month in Washington, on seeing that one of the leading papers by the distinguished gentleman who will address you later, our friend Dr. Billings, of Washington, D. C., was entitled "Methods of Teaching Surgery." It developed what to my mind was one of the most fruitful, and to me personally one of the most useful, debates that was ever held in that body.

Dr. Billings considered in that address three points,—who were to be taught, what was to be taught, and how it was to be taught. The very scope of his paper, perhaps, prevented consideration of what is, I think, of as much importance as the methods of teaching; namely, the men who teach. I would like much to see delivered before all of the boards of trustees of our medical schools in this country (and I think the faculties might benefit quite as much) a course of lectures on "How to Conduct a Medical School, and Who Ought to be Made Professors in it." Trustees should not select men because they are their friends, nor because they are their family physicians, nor because they are related to them in *any* way; but there should be *one sole requisite* for the position of a teacher—that he should be the best and most capable man to teach.

Moreover, I should be very sorry indeed to see the day when the practitioner and the professor are to be divorced. I do not know anything that is more enlivening, that renders a man's lectures more juicy, more meaty, than to have the varied experiences, the successes, the failures, the perplexities, and the responsibilities of an active practice. These very men on the benches before him are the men who are to follow him and his colleagues in the actual practice of the profession; and what they want is, not only science, but the applications of science to everyday practice. I care not what the department is, be it chemistry, be it anatomy, be it pathological anatomy, be it any of even the purely scientific departments (except possibly physiology), if a man wants to teach it in a live way, in a way that will make the knowledge stick, in a way that will make it interesting and attractive instead of a dry statement of facts, he must make the application of almost every fact in his scientific teaching to practice, he must show their practical bearings by cases drawn from his own practice. Along with that, however, I believe that the time will come when the men who are professors in our schools and at the same time practitioners will largely change their methods of practice. A man who is engrossed in a very large private practice often finds it difficult to give that amount of time which the newer education and the newer methods of instruction of classes in small sections require; and I believe that in the future the professors in our medical schools will be more and more restricted in their practice until, eventually, they will practise in the hospital, give their lectures, and do little or no outside practice. This will require, of course, very much larger salaries than now can be given, where the income of the school is derived from fees; and, in order to do this, it is requisite to have large endowments of the medical schools.

You all know the great need, the crying need, of our medical schools at the present day is larger and more thorough laboratory facilities; and that means immense sums of money. I do not know anything more striking than the figures given by Professor Welch in a recent address, in which, collecting all the statistics from the medical schools for 1893, he showed that independently of buildings, I believe, the permanent investments yielding revenues to medical schools in this country were but little over $600,000, and the endowments yielding revenues to theological schools were $17,600,000. I believe thoroughly in taking care of the souls of the community; but I put it to you, and through you to the community, gentlemen, whether there is not a vast disproportion in the discharge of a duty that the public owes to medical education in a country where we cannot depend upon State aid, when they have only given a paltry $600,000 to us as contrasted with the millions for theological instruction. Observe that these figures apply only to medical schools, and not to hospitals; for to them the community has been wonderfully and praiseworthily generous. But, strange to say, though they have given many millions for hospitals, their gifts to create a profession, to educate the men who are to take the care not only of the patients in these hospitals, but of their own wives and children, have been but little over a half million. It is a wonderful lack of perception—perception of the fitness of things; nay, perception of the necessity of things—that the community does not see that it is quite as much their duty to create the facilities to make better doctors as to help the invalid and injured poor.

I think another of the most important things in connection with such professors in the medical schools, and one that ought to be a duty, is that of visiting other great medical centres than their own, and seeing other men, surgeons and physicians, bacteriologists and pathologists, chemists and clinicians, do their work. I do not know anything that is more inspiring to me, or anything that I learn more from than a day in Baltimore, a day in New York, a day in Boston, from time to time, when I see other men at work, and I gain many an idea, many a good point, many a wrinkle that serves me when I am caught in some case of great perplexity. It ought to be a duty, as well as a pleasure, to every teacher to go and see other men teach; and he will learn one of two things, either how to teach better or, in some cases, how not to teach.

There are a number of points that I had noted that I should like to consider at present, but I find that the time is slipping by, and I must confine myself only to one or two. Allusion was made in Dr. Billings's address, as I said, to the students who are to be taught. I think it is a matter of great importance, in considering the requirements for admission (a subject which has also been alluded to both in the report of your Executive Committee and of the President), that the good work at the threshold of medicine should be carried further. I am glad to congratulate you, gentlemen, on the fact that it is being so nobly carried on by Harvard University. I do not know a better indication for the future of the medical profession in this country than the very fact that was alluded to by Dr. Langmaid a moment ago—of the increased requirements for admission to be exacted in 1896 in this ancient and honorable School. Now, it is perfectly true, as has been urged and as was urged anew in Washington, that we must remember that medical education is for the average medical student, that it is for the medical students who are going to the country crossroads as well as the men who are going to settle on Beacon Street, or, rather, perhaps I ought to say on Boylston Street. We must remember, however, that Harvard College can afford, gentlemen, to take an advanced stand. She can afford to do so, because she is Harvard College, because she can set the pace in this matter. You need not fear that there will not be all over the country other schools that will educate the crossroads doctor,—plenty of them. They will spring up—nay, they have sprung up—almost in every hamlet, and a good many of them have died; and the more that die, the better. As a matter of fact, there will always be enough of those who will educate men for the lower strata; but there ought to be some colleges—and Harvard University should be one of those colleges, and I am glad to say that it is one—that will educate the very *best* doctors. I believe it will be only a short time when you will fling your banner to the breeze, and say that A.B. or its equivalent shall be the absolute requirement for admission to the Harvard Medical School.

I am not one of those who would, at the present time at least, unduly lengthen our course. I alluded a moment ago to the wave of medical improvement that had swept over our methods of education. One of the best evidences of this is the large number of colleges within the very last few years —nay, within the last two years—that are urging and insisting upon a four years' medical course. It was but last week, in reading the medical journals, that I found, away off in distant Oregon, that the State Board of Medical Examiners had issued notice that after 1898 no person would be admitted to practice in the State of Oregon who had not had four years of medical study. We must look to it that in the East we are not outdone by the West. Not only our medical colleges, but our State Boards, must exact such a large and wise requirement as that, or we will be overrun with the horde of doctors that cannot find a place in the West.

Among the methods of study I can only allude to two. One is that we have not in this country at all such service as there is abroad by the Chefs de Clinique. It may possibly exist; but I am not personally aware of such instruction to practitioners as draws not only students from all parts of our own country, but—as I hope will not be far hence—from Europe as well. Only the other day I was reading a report by Dr. Laurent, of Brussels, on the medical schools of this country. He remarked in the very beginning of it that some people thought there was not very much to be learned from this country; but he added very significantly, "On marche là-bas à pas de géant." I believe that these giant strides will soon carry us to a position such that men from abroad will be able to come here and get in our own schools exactly the teaching that many of us have had in Paris or Vienna or Berlin from the Chefs de Clinique, or from men who occupy similar positions here. Its use in training the chefs themselves as clinical teachers would by no means be its least useful function.

Second, a great deal has been said of late in reference to the value of recitation as opposed to didactic instruction.

Now, I believe thoroughly in recitations. I am glad to see that Harvard has established them. I believe they ought to be official; that is to say, compulsory. Every man of the class should go before the examiner from day to day, and not merely before the professor for an examination at the end of his term; and he should be marked by this official quiz-master, and his standing be determined by his recitations as well as by his final examination. But, gentlemen, I do not believe that the time will ever come when the living voice, and the personality of the speaker, will be discontinued and forgotten. I shall never forget, for instance, one story that was told by dear old Charles D. Meigs, whom you remember, perhaps, as being rather worsted in the fight with Dr. Holmes over the contagiousness of puerperal fever. It was an illustration to emphasize the point which he wished to inculcate in his obstetrical lectures, that the child should be put to the breast very early. He gave a description, which I will not attempt to rival,—for it is one of the most beautiful pieces of poetry in prose that I ever heard,—of the birth of Cain. He pictured the beautiful bower to which Eve retired and the pains that she suddenly felt, which—for it was a novel experience to her—she thought must be due to some grapes that she had eaten the day before that had disagreed with her. Finally, she fainted away for a moment. Then, on waking, she found her slippery little Cain, and, lifting him up in surprise in her arms, he fell into nature's cradle, and immediately took the breast. It was a very simple little story, but it was beautifully told; and to this day, more than thirty years since, it is as fresh to me in its grace and in its lesson as it was then. And, again, I shall never forget the power of Samuel D. Gross. When, in lecturing on diseases of joints, he began with the question of treatment, looking round the amphitheatre very quietly, he said, "The first requisite in the treatment of inflammation of a joint is rest," then after a pause, "*rest*"; and then, rising to his full height and folding his arms, he bent majestically forward, and repeated, "In the name of God, Rest." Now you might read that ten times in a book, and forget it the next minute; but once hear it from the lips of Gross, with his tall form, fine figure, and handsome, earnest face, and I would defy you ever to forget it.

THE ADVANTAGES OF AN ACADEMIC TRAINING FOR A MEDICAL CAREER.*

THE time is rapidly approaching when all over the country our colleges will send forth several thousand young men to begin their active work in life. The necessity for a wise decision as to what shall be each man's career needs no comment.

The Editor of the "Brown University Magazine" has asked me to present to its readers some of the advantages which attend an academic training before entering upon a medical career. Before doing so, however, I must add a word of commendation of the excellent work of the Brown University Medical Association, which has done so much to foster the medical idea among the students of the University, and to suggest changes and improvements in the college curriculum which adapt it to the requirements of future students.

As a teacher of surgery for now just thirty years, I feel that I may speak with some confidence as to these advantages, and it is with no little pleasure that in my own case I have always recognized the fact that whatever success may have attended either my writing, my practice, or my teaching has been due chiefly to the training I received in my dear Alma Mater. The logical acumen of Chace, the inspiration from Lincoln, the rhetorical grace and fine criticism of Dunn, the historical generalizations of Gammell, and the extraordinary knowledge of Sears all had a most influential part in forming my mind and shaping my subsequent life. I can

* Reprinted from the Brown University Magazine for April, 1896.

never be grateful enough to them and their colleagues in the then Faculty, and I feel it is but a very small repayment on account of a large debt when I can do anything for Brown University.

That college men take precedence of others who have missed such invaluable training is shown by the statistics some time since quoted by the "Medical Record." Of 912 physicians deemed worthy of notice in Appleton's "American Cyclopædia of Biography," 473 are college-trained men. The "Record" estimated that during the present century about 300,000 men have entered the medical profession. Of these, therefore, nearly 1000, that is about 1 in 300, had gained more or less prominence. But on the basis of there being about 500 of these latter who were college men, the chances of distinction and influence for a college-bred man in medicine were increased from 1 in 300 to 1 in 60, or five times as great as if he had not had such intellectual training.

Never has there been a time when the demand for the best and ripest intellect in medicine was more pronounced than at present. The medical horizon is broadening most rapidly. The complexity of the problems constantly presented by disease and by the conditions of modern social life and the multiplicity of the means of investigating them; the logical methods necessary for the solution of these problems; the laboratory facilities which are required to that end; the relation of medicine to public health in matters of sanitation both for the individual and for the public, in peace and in war, in city and in country, all attest the marvelous activity of the medical mind.

To anyone about to enter upon such a life, the question will naturally occur: what are the requirements for such a professional career?

They may be stated, I think, under four headings: first, that a man shall have a strong body and an active mind; secondly, that he shall have the ability to acquire knowledge; thirdly, that he shall have the ability to use this knowledge; and, fourthly, that he shall have the ability to impart this knowledge.

As to the first, it has been a great pleasure to me in the years since I graduated to see what enormous strides have been made in the development of vigorous bodies in our college men. Saving for a few who took to rowing and for some sporadic games of ball, which would now be laughed to scorn, there were no athletics in my day. A few men went to a gymnasium in the city, but the great bulk of students at that time if they kept their health were fortunate. If they lost it, they were not blamed, though, as we all now know, it was largely their own fault. But I am thankful that at the present day the most important class of the future citizens of the republic, from the intellectual point of view, are also bound to be the strongest and best from the physical point of view, and that the men who are going to influence our public affairs in the senate, at the bar, in the pulpit, in engineering, in commerce, and at the bedside are to be men of a wholly different physique from those of thirty years ago. Moreover, the athletic field does far more for men than merely give them a strong body. It develops mental and moral characteristics of the highest order and the greatest importance in the later struggle for existence. But to the students of a college whose President has more than once declared himself convinced of the importance and value of athletics, both to scholarship and health, as President Andrews has done, it is not necessary for me further to enter upon this subject.

The strain of a medical life is very severe. The loss of sleep during many continuous hours of service (and the severer and more responsible the case, the greater the likelihood of such long hours of endurance); the responsibility which attaches to him who holds a human life in his hand; the acute nervous strain of difficult surgical operations; the need of constant study and the necessity for the relinquishment of most of the recreations of life, all require that the physician should be, above all, a strong man both physically and mentally, or he will be in one respect or another unequal to the task set before him.

II. Let us turn, however, now to the more immediate professional requirements, for it may be well said that strength of body and alertness of mind are prerequisites for every calling. In many years of teaching I have seen large numbers of students, and I have been struck with the great differences in their ability to acquire knowledge; not only that personal difference, which one may say is inherited in nearly all men, but in their mode of handling intellectual tools; in their ability to grasp and master ideas; in their quick comprehension of logical sequences; in their correlation of ideas, which is but another way of saying that there is a difference in seeing the bearing and value of any one fact, physical sign, or medical symptom, a faculty which one man will possess in largest measure and another in least, if, indeed, he possesses it at all. This very difference in the ability of the trained mind to acquire more knowledge in less time than the untrained mind has led the Jefferson Medical College and several other of the leading colleges to admit students with a University degree, and who have pursued certain studies covering largely those of the first year in medicine as well as the last year in a college course, to advanced standing in the second year, thus requiring them only to devote three years to their technical training, instead of four years, or, including the college course, seven years instead of eight.

A man who goes through Brown, Princeton, Harvard, Yale, etc., is furnished with a knowledge of chemistry, biology, physiology, anatomy, and other branches such that he has not only acquired a large part of the knowledge of the first year in the medical school, but, above all, has learned how to learn. In a given time he will acquire double the knowledge that the man fresh from the counter or the plough or even the High School can obtain. More than this, there is developed by such a college training a subtle ability to distinguish that which is essential from that which is incidental or accidental, which enables a college man quickly to get a broad, fundamental knowledge that the non-trained man can never get. This is not saying, of course, that there are no exceptions; but, as we all know, exceptions, by the very fact of their being such, prove the rule.

Even in one single small thing, which, however, counts for more than would appear upon the surface, the very knowledge of Greek and Latin, from which the vast bulk of our medical terms are coined, facilitates the gaining of knowledge, and, more than that, gives a man an insight into the real meaning of terms, which the man who simply takes them *memoriter* knows nothing about. But, happily, academic studies are not limited now as formerly to the narrow range of Latin, Greek, mathematics, history, logic, rhetoric, and their allies, but have widened their scope, and embrace very many of the scientific branches of the day. Whatever advantage may have been considered to arise from the study of Greek and Latin as means of training the mind and its logical powers, there is no question that science develops power of acute observation which no mere literary course can give; that upon these facts so observed is built a series of logical propositions as technical, as difficult, as acute as any that may be found in philosophy or literature. The men, therefore, who come from our colleges to the study of medicine have had to a very large extent their powers of observation and of logical deduction developed far more than the untrained minds of the ordinary country or even city young man. I know of no one who needs a training in strict logical methods more than the doctor.

Anyone who follows carefully the experiments, reasoning, and conclusions of Bernard in his physiological discoveries;

of Pasteur in his brilliant researches on the diseases of the silkworm, on fermentation, on spontaneous generation, or on hydrophobia; or of Lister in his search, first for efficient and then for better antiseptic methods, can reach no other conclusion than that logic can handle facts as well as ideas, and that mental training is both acquired and developed in the highest degree by such scientific researches. The problems of bacteriology, and recently the questions reaching even to the very constitution of matter and force involved in Roentgen's discovery of the x-rays, demand the highest order of mental equipment.

It must be observed again that the advantages of academic training, while I am endeavoring to state them especially from the view of the prospective medical student, endure far beyond that period of life. He who has studied the humanities under inspiring teachers has had developed in his mind a love of letters and appreciation of the highest and best and noblest in literature, ancient and modern, in English, in foreign tongues, in prose or in verse, which will be a never-ending well-spring of joy in him. If he becomes a successful and busy practitioner in any branch of medicine he will have far too little time to give to those studies which polish the mind and adorn the character. But it will be to him a joy that he has had at least a taste, which has but whetted his appetite for more, and will lead him to steal many a delightful hour, even from sleep, for such enjoyment. He will be none the worse a doctor if he can read an ode of Horace, or a page of Homer, nor will he handle the scalpel any less deftly if he knows Shakespeare by heart or owns a well-thumbed Goethe.

III. Having acquired a certain amount of learning as to the fundamentals of medicine, the doctor starts out on his career. However great or small his scientific acquirements, they must all be turned to the final cause of his being a doctor: namely, to the cure of his patients. How does a doctor approach this problem, which awaits his solution with every patient whom he sees? There are four stages. First, the facts as to the history of his patient. This history is both personal and family. He not only wants to know when this present illness or tumor began, and the symptoms which have attended its development, but what was its cause—a cause which may be hidden in the present habits, earlier surroundings, or former diseases of his patients. More than this, so strong is the influence of one generation upon another that a large number of diseases are dependent upon tendencies inherited from ancestors; not from only one, but it may be even more than one, prior generation. And it is strange how very inaccurate large numbers, even of intelligent persons, are; their remembrance of facts so uncertain; their observation of physical conditions so vague and indefinite. It often requires all the skill in cross-examination that is expected of an acute attorney to get at the real facts of the case.

When these are set in order, then comes, secondly, the physical examination. Here nature is often treacherous and juggles with us, even on the edge of the grave. Touch, sight, and hearing must all be called into co-ordinate energy, and all be guided by a clear, logical mind, or again we shall not get the right facts as to the physical condition of the patient. The physical signs being ascertained, what are the deductions to be drawn from them? Here comes constantly the value of academic training. Many a fact, which seems at first glance to be important, simply because it is upon the surface and is first observed, is pushed aside at once by the logical mind of the college-trained man. He has learned by long experience how to see through the superficial to the deep, through the accidental to the essential; or, it may be, often through the mimicry of disease to the true disorder. Having, therefore, deduced certain logical conclusions as to the malady, or injury, or surgical condition, he is finally prompt in the selection of the remedy, whether it be drug or diet or the knife, and his decision of character impresses his patients with a confidence in his skill, which a friendly and a kindly demeanor enhances. This assures him success in his profession.

IV. No man in any calling of life can live alone; nor can the doctor. Even with his very first patient he must use tact as well as skill clearly to set forth the nature of the trouble, and the need for the regimen or operation he advises, or to satisfy a timid patient with such thoughtful and guarded statement of the truth as will not needlessly alarm, and yet will invite and insure obedience. To state this accurately, truthfully, and convincingly, and yet not too bluntly, is one of the largest elements in the character of a successful practitioner. But not only is this required in relation to his individual patients. He must impart his knowledge to the profession; and the place that a man takes among his fellows, both of his own calling and in the entire community, depends not a little on his ability to set forth his ideas clearly, logically, forcibly. The training of tongue and pen that a man gets in Brown University is simply invaluable in training him to formulate such statements of truth. The man who in medical societies shows that his judgment is good, that he is familiar with the literature of the subject, that he knows what is going on, that he is progressive and keeps up with the times, and then can state his views in a forceful, convincing way, becomes a man of power; a man whose judgment is sought for, whose advice is asked by his brother-practitioners. And it does not take long for the public to find out what doctor is most trusted by other doctors. He is the man they want for themselves.

Such papers find their way usually into our medical journals, which stand in the same relation to the more elaborate and systematic, but less fresh, books which are issued from the medical press that the newspapers do to serious works of history. A man's reputation is built up largely on the papers which he writes and presents at such societies and are published in the medical journals; and all that I have said above applies to such published papers, and still further, of course, to formal statements of knowledge in books. The wretched, slovenly style that one often sees both in journal articles and books is not surprising when we consider how relatively few men there are who cultivate the rhetorical graces of style. As Dr. Billings some time ago pointed out, even the very title of a paper is often badly chosen. If I am searching, for instance, for all the published cases of gunshot wound of the kidney for the purpose of analyzing them and determining the value both of the symptoms and the physical signs and of the methods of treatment, in going over the "Index Medicus" to collect the recorded cases am I likely to look at a paper which may relate a most interesting and important case of gunshot wound of the kidney which hides it under the vague title of "Two Interesting Surgical Operations"? The title of a paper or of a book is like the name of a man. It should be distinctive, so that one may always refer to it and know precisely what it is about.

But not a few doctors become prominent teachers. The number of men who teach in any one of our medical schools is relatively small, yet the aggregate number of teachers in the profession is very large. While the art of teaching is, to some extent, innate, no man will make a thoroughly good and successful teacher unless he has had more or less of such a college training. The ability to set forth his ideas in logical order, in natural sequence, passing from the known to the unknown, from facts to deductions, and with at least a reasonable degree of rhetorical grace is a gift which is susceptible of the greatest possible development by training. Even great geniuses who have lacked such training, such as John Hunter, have always been hampered to their very graves by their inability to express themselves in graceful and yet forceful English.

I might go further, did time permit, but I will only allude to one final advantage, as it seems to me, of a college training, and that is on the moral and spiritual side. Whatever may be a man's relation to any individual religious belief, it is scarcely possible for him to go through the four years of a college course without rising to a higher moral plane, without having developed within him the spiritual side of his nature by his contact with earnest men of various faiths. I would trust a college man more quickly than I would any other man morally and spiritually, as well as intellectually, for I believe, though there are vices and evil influences in every college, yet, on the whole, the influence of a college life makes for righteousness as well as for knowledge. When we reflect that the physician's influence begins, even before birth and only ends with the grave itself; when we consider his intimate and personal sacred relations with all the members of a family; that he is the repository of facts which he must no more disclose than the listening walls of his consulting room; when we consider the confidence that is bestowed upon him, how intimately his advice affects the whole future, not only physical, but intellectual and moral, of so many of his patients, surely there is need for such a man to live, not only on the highest intellectual level, but on the highest moral plane. If he does not, he is unworthy of the noble profession which he ought to adorn.

LITERARY METHODS IN MEDICINE.*

GENTLEMEN:

MY subject this evening is "Literary Methods in Medicine," and I have selected it for this reason: I well remember how I floundered around in my early medical career, and the many mistakes I made, until I finally evolved from my own experience, together with suggestions from friends with whom I talked on the matter, a method of my own. This method I shall describe to you, and, as it has been very satisfactory to myself, I think it may be of use to you. If you will look in the "Medical News" for August 12, 1893, you will see a similar very admirable paper by Dr. Bayard Holmes, of Chicago, who, so far as I know, has done the best work in this country with a view of urging students of medicine and doctors to follow out a reasonable, feasible, and practical method of making their knowledge available, first to themselves, and secondly to others.

I purpose to speak to you on two topics,—first, "case-taking," and, second, the writing of papers, or "case-using." I would be very glad if you would make notes as we go along, as I think they will be useful to you hereafter.

I. *Case-taking.*—Some of you will become residents in the Jefferson and other hospitals. You will want to write up the history also of your private cases, and, therefore, you must know how to do it.

First, record the name of the person. If the patient is a child, always record the father's name, or, if the father be

* A lecture delivered before the W. W. Keen Surgical Society of the Jefferson Medical College. Reprinted from International Clinics, vol. i, seventh series, April, 1897, by permission of J. B. Lippincott Co.

not living, the mother's. You will very possibly, years later, want to find out the after-history of the patient. A child may thus be reached through the parents. If you are dealing with a married woman, record her husband's name, as, if his name is in the directory, you will be able to reach him, and through him the wife. Always record, also, the name of the family physician and his address, so that you may obtain later information from him. Next, note the residence, then the age, and then the occupation. The occupation has very often a great deal to do with disease. A recent case in the Jefferson Hospital, in which the cause of necrosis of a large part of the pubic bone was at the first glance inexplicable, is a good illustration. When I learned that the man worked in an iron foundry, and used an iron tool with a long handle, which he pushed forward by the pressure of his body, the cause became clear. This pressure was, of course, the cause of the necrosis.

I remember a good story told of a doctor who insisted that his patient did not take enough exercise, in spite of the man's protests that he did. Suddenly he asked the man's occupation. "Postman, sir," was the unexpected and embarrassing though convincing reply.

Next, note the height, and then the weight, so as to determine whether the person's weight is out of proportion to the height, and whether he is fat or thin. Get both the best weight and the present weight. If a year ago a man weighed one hundred and forty pounds and to-day one hundred pounds, there is some serious trouble, possibly cancer of some of the digestive organs or other part of the body. The loss of weight will often put you on the track of the disorder. Inquire into and record the patient's habits as to eating and drinking, and especially over-indulgence in either, particularly as to alcohol, and often into his sexual habits and illicit indulgence.

Having recorded these preliminary observations, you must get the *family history*, to see whether heredity has had anything to do with the case. Inquire into the age and health of the patient's father and mother if living, or, if they are dead, how old they were and the cause of death; also the age and cause of death of the grandparents, as well as of the uncles and aunts on both sides. Ask especially as to tuberculosis and cancer. In this way you may determine the question of heredity.

Having thus obtained the family history, we next come to the *personal history*. You will first inquire what prior illness or accident the patient has had. You will very often find that this is a difficult task. You must have the shrewdness of a lawyer in cross-questioning your patient in order to determine the facts of the personal history. As an illustration of this I may mention the case of a little girl who was brought to my clinic at the Orthopædic Hospital a few weeks ago, to be treated for curvature of the spine. That was all I was told of her history. I asked for more data, and only to-day her mother remembered that a year ago she was subject to very severe attacks of pain, especially in the right iliac fossa, and that she had had at that time, and at intervals of from four to six weeks since, a discharge of pus from the vagina. A discharge of pus from the vagina in a girl of seven was a fact of prime importance which the mother had entirely neglected to tell me about.

If in the previous history there is noted an accident, you will want to inquire particularly into the details of that accident. As an example of this, a man may tell you that he had a fall and injured his head. If you record only this, you have made a most imperfect record. You must know whether the man was struck severely enough to tear his scalp or fracture his skull; whether he was unconscious; if unconscious, when he came to himself, and whether he was able to get up and walk home, as well as what later symptoms were observed. All these details, you will observe, are very important for you to obtain in connection with the prior history before the present illness began. When you have to do with a woman, you will wish to know her personal history in relation to her sexual organs; when menstruation began and its character: when married; how many children; how many miscarriages; whether her labors were normal or instrumental; whether or not she nursed her children; whether or not she has had any trouble with her breasts or the pelvic organs. These facts may have a very important bearing on the history of your patient. In both sexes, but especially in men, you must inquire as to syphilis, acquired or hereditary. Here your ingenuity and tact will often be taxed to the utmost to get at the truth. If the facts observed are in favor of a syphilitic history, you must disregard denials, but you will record both the denial and the facts. In married women you must often avoid the direct question, and reach the facts indirectly by inquiring as to the loss of hair, sore throat, sore eyes, blotches on the skin, etc. In all cases observe the teeth for evidence of inherited syphilis.

Then you come to the history of the *present illness*,—first, when it began, and, second, how it began; what took place at the beginning of the illness, and whether any new features have developed since; whether the conditions first existing became worse or better, and as to there having been relapses. Next you wish to ascertain and describe the present condition. Frequently you will find this written as "S. P.," meaning *status præsens*, or the present condition of the patient. You will want to state whether the patient is apparently in good or ill health; whether there is any evidence of long-continued illness; note anything that strikes you particularly as to the general appearance of your patient. Then begin to describe the present symptoms. You will first state whether any pain exists anywhere; any tenderness, any swelling, or other evidence of a tumor. When you have described the present general condition and symptoms, you will wish to ascertain the local conditions and the physical examination, as, for instance, of a tumor of the breast; in which quadrant of the breast it exists; if the nipple is retracted; and let me say here that if it is not retracted, do not let this fact pass without comment. It is important to state negatives as well as positives, not only as to this, but many other conditions. State if there is any discharge from the nipple when you squeeze the breast. If there is a lump, you must describe the size. Do not say it is as big as an apple or the size of a cherry. You may say it is the shape of a cherry if you choose, but you would better say it is globular. State the diameter, whether it be one inch or two inches, or better still use the Metric System. You feel the tumor, and state whether it is hard, elastic, lobulated, and whether it is ulcerated. In that way you give to the reader of your paper some idea of what you find. If it is possible, always give the circumference as well as the diameter. In the case of a goitre or other tumor, give not only the transverse and the vertical measurements, but also the circumference from one side to the other, and that the girth of the neck was so many inches. If possible, use French centimetres, as this is much better than English inches.

You will wish to preserve any photographs, drawings, or sketches that you may have secured in connection with the case. These various charts that I show you are very good for this purpose. These are "clinical charts" I devised many years ago, and can be had from P. Blakiston's Son & Co. in pads. These are stencil charts in use at the Orthopædic Hospital. In the case of tumors, draw an outline of them, and state such things as that the right side was dull or tympanitic, etc.

I cannot too strongly urge that you should make a careful, thorough physical examination in every case. Some time ago I quickly discovered that a gentleman had a cancer of the rectum. He had suffered with tenesmus, pain, difficult defecation, and blood in the stools. You will scarcely believe me, that though for two years the man had suffered in this way, his physician had never once passed his finger into the rectum! If he had done so he would have instantly ascertained that the man had a cancer. Another example was that of a gentleman who complained very much of similar symptoms and of the small diameter of the stools, they being no larger than the little finger. No examination of the abdomen had been made. On examination of the left iliac fossa I found a lump there two inches in diameter, which proved to be a cancer of the colon, and accounted for the condition present.

Now that you have the history, what will you do with it? Let me tell you my own method. Different surgeons and physicians pursue many different methods, more or less good. My own method is one that has been evolved from a good deal of experience, and has served not only myself, but many of my friends. Either write out your cases on sheets of paper,—and I think the best kind is the legal cap,—or, if you have the luxury, dictate them to a stenographer. File them alphabetically. I have in these two files my cases from January 1, 1895, to January 1, 1896. Commonly I use two of these in a year, the first containing the names from A to L, the second from M to Z. They are called the "Shannon binding cases," and may be obtained of any stationer. The notes of each case can be removed from the file in a moment without disturbing the others. With the notes I file photographs, sketches, or diagrams of the case. Unmounted photographs are better for filing than the mounted. When an operation is done, write up its description at once, so as not to forget the details. From time to time you will add the later notes to complete the history. When the history is finished I file also the temperature chart and any other additional records.

When you have taken these, it may be, elaborate notes and filed them, you want to make this mass of notes available. You must, therefore, index them. First index every case by *name*, and secondly by *disease* or *operation* or *complication*. A double catalogue is therefore indispensable. The Library Bureau supplies every necessary appliance for large and small libraries, including cards of a uniform size, but varying thicknesses (I always use a medium weight). Neat cases, holding two, four, six, or more drawers, in which the cards fit exactly, with taller cards on which the alphabetical divisions are written projecting a little above the other cards, are placed at convenient spaces, to enable one readily to find the desired card. By all means get these inexpensive cards at once. The case holding the cards you can get later, when your patients are more numerous and your purses better filled. Simple envelope boxes will answer very well for the first few years. Here are two drawers from my own card catalogue of my cases. In the first are the names of all the patients whose histories I have from A to L. In another those from M to Z.

They are indexed under A, B, C, etc., and are then subdivided by the first vowel in the name. Bates would be under Ba, Bloodgood under Bo, and so on. If I wish, for example, to find the history of Harry Fell, I turn to "Fell, Harry," and find his case recorded as "right-sided neurectomy of posterior cervical nerves, 1894"; then I go to my case files for 1894, turn to F, and quickly find his complete history. To-day a patient came into my office and reported his later history after a neurectomy of the second and the third divisions of the fifth nerve, and I at once looked up the notes and added this information to the history in order to bring it up to date.

But you not only want your cases indexed by names, but by diseases, operations, or complication. I have, therefore, another set of drawers with cards on which are indexed all my cases, classified by the disease or the operation, or the complication, in the one drawer from A to L and the other from M to Z, and subclassified by the first vowel of each disease or operation. In indexing the cases on this set of cards I will often index the same case under two or three or sometimes even more headings. Thus an aneurism of the popliteal, for which I ligated the femoral, would be indexed under "Artery, popliteal, ligation of femoral artery for aneurism of, John F. Smith, 1895,"—i. e., in the file for 1895; "Artery, femoral, ligation of, for popliteal aneurism, John F. Smith, 1895"; and "Aneurism, popliteal, ligation of femoral artery, John F. Smith, 1895." If I removed some enlarged tuberculous glands of the neck, and was obliged in the course of the operation to ligate the jugular vein, I would index it under "Neck, tuberculous glands of, extirpation of, with ligation of jugular, Peter Jones, 1891," and also under "Vein, jugular, ligation of, during removal of tuberculous glands, Peter Jones, 1891." If the thoracic duct was injured during the operation, I would add another reference under "Thoracic duct, injury of, during extirpation of tuberculous glands, Peter Jones, 1891." In a moment, by turning to my files for 1895 or 1891, I could find the histories of Smith, John F., or Jones, Peter.

If I want to write a paper supplementing that of Samuel W. Gross on ligation of large veins, I can quickly find all the data I possess under "vein," whether it be the "jugular," "axillary" "femoral," or any other. Each of these large veins would have its own card.

Of course, this method means a good deal of labor and takes a great deal of time. It pays, however, and you always have your knowledge available. You can put your hands right on it, and is far better than to trust to a faulty memory. Inevitably you will forget a great many cases. Even if you remember them, you will forget the salient points you would have noted at the time.

Suppose you do not follow such a system, what will you have to do? With far greater labor and far less perfect results, you must hunt through the indexes of various journals and books for what you want. Only those who have undertaken such labor know what patience, diligence, and pains are required to attain what you wish, and then most imperfectly.

Let me beg of you to begin this or some other system at once. The moment you graduate begin taking notes of your cases. From lack of such a system a large number of cases that occurred in my earlier experience have been wholly lost. I did not write the details down at the time.

First, therefore, take your notes carefully; second, file them away; third, index them by name; and fourth, index them by disease, operation, or complication in the way I have mentioned.

Now, how will you use them? This brings us to the second point.

II. *Case-using.*—You can refer to your own cases very readily. But you will want to know in writing any particular paper, what other surgeons have said about the subject, for there have been wise men before you. You must know what experience they have had, what disasters they have met with, and how they have overcome them, for this will act as a warning and also as an encouragement to you. You will find many brilliant ideas new to you that were known fifty years ago. Unless you look up what has been written by your predecessors in books and medical journals you will often be brought to shame and grief.

What facilities, then, are there in the way of books? The large medical libraries of the country are practically found in only five cities. First and foremost, not only in this country, but in the world, is the library of the Surgeon-General of the Army in Washington. Begun during the war, it has now grown to be by far the most important medical library in the world, and it is made splendidly available to the entire profession. At any time that I wish a book not in this city I can get it from Washington by a very simple process. I go to the librarian of the College of Physicians and give him a list of the books I need. He writes to Washington for them, and they are sent not to me, but to the library of the College. I can go there and spend all the time that I want in reading them over. The surgeon-general's library is free to the entire profession throughout the country. All I have to do is to pay the expressage both ways; there is no fee for the use of the books. This liberal and most laudable arrangement was inaugurated by Dr. John S. Billings. Secondly, we have here in this city at the College of Physicians the next most important library. It is a magnificent library, larger than any other medical library in the country excepting that of the Surgeon-General's Office. In the Pennsylvania Hospital in this city we have also a very valuable library as far as it goes, although it is not as large as that of the College of Physicians.

If you are in or near New York, you can use two large libraries there,—that of the New York Hospital, and, still more important, the library of the Academy of Medicine.*

In Boston you can use the library of the Boston Medical Library Association, which is one of the most valuable in this country. In Chicago you can consult the books of the Newberry Library. There are in a great many of the minor medical centres small local libraries, as, for instance, in Cleveland, where there has recently been started by a number of energetic doctors the beginning of a very excellent library.† I hope one of the first things you will do will be to join with your brother-physicians in starting a good local library. All of

* Since this address was written (1897) the New York Hospital Library has been given to the Academy of Medicine.—(W. W. K., 1905.)

† Many other local medical libraries have been started since 1897

these libraries have card catalogues such as those I have described.

Supposing now that you have not access to any large public library; what will you do? First, you will want to buy the best books for your own library. Even if you are not interested in any special department, but are general practitioners, as I presume most of you will be, there are books in many special departments which you will always want to buy for your library in addition to such as treat of medicine, surgery, gynæcology, etc., in general. Some of you who can afford it will do this readily, others less quickly. Every one of you will, I hope, found somewhat of a library. The man who has ten books is only one-half as good as he who has twenty,—and has read them.

Next, with regard to medical journals. If you read Bancroft's history of the United States, and after that McMaster's, you would have some knowledge of the history of the country, but you observe that your history would date back to when the book was written. So in text-books. The author cannot issue a new edition every year. They must come out at certain intervals of two to five years or more. Meantime, what are you going to do? There is constant progress going on, and you must keep up with it. You keep up with civic affairs by reading the newspapers, and the newspaper is to history what the medical journal is to medical books. I have brought quite a number of journals in order to say a word to you in reference to them. First, take your local journal. Never mind where you are, always take the journal in your own neighborhood. Very likely this will be a small journal, and will not give you all the information you need, so you must take some others. Let me point out to you a few of the various journals which I take. Of course, I speak only of surgery, and no other department. We will take the American journals first. Here is the "Annals of Surgery," of which two volumes are issued annually. In this you get original papers and a very admirable review of the surgical work of the world. I get as much out of this as any other surgical journal I see. I have here the oldest medical journal in the world, the "American Journal of the Medical Sciences," published monthly in this city. This is volume cxii, which terminated on December 31. Like the "Annals of Surgery," this consists of original papers, reviews of books, and finally a résumé of the more important recent medical papers. Here is another journal published in New York, the "Medical News," of which I have here a single weekly number and a bound volume. In this there are original papers, proceedings of medical societies, selections from other journals, etc. This is a copy of the "New York Medical Record," a weekly, and this is one of the bound volumes for six months of the year. This is the "New York Medical Journal." These are two excellent journals, both of the same type as the "Medical News." A number of other excellent American journals, such as the "Boston Medical and Surgical Journal," the "International Medical Magazine," the "Journal of the American Medical Association," the "Medical and Surgical Reporter," etc., I see regularly in a small "journal club." Here are two English periodicals. This is the old one that so many of you are familiar with,—at least by its name, now a happy misnomer,—the "Lancet." This is the "British Medical Journal," and these two are the best journals published in Great Britian, not only for surgery, but for medicine, obstetrics, gynæcology, the ear, the eye, and, in fact, every department of medicine. They are universal journals in that respect.

I will now show you some of the Continental journals, and this leads me to urge you all, if possible, by all means to learn at least one other language than your mother-tongue. When you have acquired another language you have doubled yourself. If you have an opportunity of studying only one, study German. This is the hardest language, perhaps, but it is certainly by far the most desirable at the present time for papers and books on the practice of medicine and surgery.

Add French to German if at all possible, for there is much that is valuable in that language. Let me show you a few of the foreign journals which I take myself. Here are single numbers of the "Deutsche Zeitschrift für Chirurgie" and the "Beiträge zur klinischen Chirurgie," and here are bound volumes of each. This is another one, founded by the great Langenbeck, the "Archiv für klinischen Chirurgie," and here is one of the volumes. This is a smaller weekly journal, the "Centralblatt für Chirurgie," which has often one important paper at the beginning, while all the rest consists of free abstracts of the important surgical papers of the world. If you take only one German journal, this is the one I would advise you to take. It makes one large volume for each year. In the "Deutsche medicinische Wochenschrift," the "Berliner klinische Wochenschrift," the "Wiener medicinische Wochenschrift," and the "Wiener Klinik" you will find many important contributions to medicine, surgery, obstetrics, etc.

In French literature you will find less of importance, although there is a good deal. I take these two journals, the "Revue de Chirurgie" and the "Archives provinciales de Chirurgie."

When you first enter in practice you most probably will not be able to subscribe to so many journals, but you can read a number of them at small expense by forming a "Journal Club" of from half a dozen to a dozen neighboring doctors who will pay, say five or six dollars a year each. With this money you subscribe to as many journals as your money will buy and pass them from week to week around the club. The journals are sold to the highest bidder, to whom they are delivered after having been seen by all the club, and this will add to the receipts of the club.

Not only are these and many other journals of value, but you will find "year-books" in which are gathered all the more important papers of each year. I think the best one in this country is the "American Year-book of Medicine and Surgery." It is a large book, with a good many illustrations. This is the volume for last year. It consists of articles, criticisms, and suggestions. One who reads this carefully will keep well up in all departments of medicine. Every year there is published by Dr. Sajous of this city the "Annual of the Universal Medical Sciences." It consists of five volumes each year, and I have brought one volume as a specimen. "International Clinics" consists of four volumes a year of valuable clinical lectures in many departments, from which you will gain much.

I have spoken to you of books, of journals, and of year-books, but you cannot be expected to remember all of the articles you read. How are you going to make them useful? Just in the same way you make your cases useful. Have a second card catalogue for all such articles and books. I have brought one drawer of my own card catalogue along to show you how it is done. I saw, for example, the other day in the "Boston Medical and Surgical Journal," by Higgins, a case of Kraske's operation for imperforate rectum. In the "Medical News" I soon came across a second by Elliot, and the case I myself operated on the other day is the third case. Immediately that I read the first two I catalogued them under "Rectum, imperforate, Kraske's operation for," giving the author, the journal, the volume, year, and page. I also catalogued them under "Kraske's operation for imperforate rectum." When, then, I had such a case myself, in a moment I could refer to all the prior cases I had seen recorded, and thus learn the advantages, the disasters, and the results of prior cases, and embody them in any paper I may wish to write, and in my daily work can avail myself of the experience, both favorable and unfavorable, of my predecessors, and if possible improve upon their methods. Sometimes I do not have time to read the articles at the moment, but I catalogue them. If I have occasion thereafter to refer to the topic, I can find the paper and can immediately get access to it and read it. In this catalogue I follow the same plan that I do with my cases. If during a reported operation on the neck the internal jugular was divided, I would catalogue that under "Vein, jugular," and also under "Neck, glands of." In that way I not only catalogue the important papers, but also the details. Murphy's button is a new appliance. When I treat a case of gastro-enterostomy or ileo-colostomy or intestinal anastomosis in which Murphy's button has been used, I would catalogue that under the disease and also under "Murphy's button." If successful, it is so recorded. If an accident happens and the button is retained, or sloughing follows, I refer to it in my catalogue. If I read John Hunter's "Life" and find a statement I want to refer to, I catalogue it with volume and page under one, two, or three headings. In this catalogue of papers, and also in my cases, I make cross-references, as, for example, cancer of the rectum is so closely allied to cancer of the sigmoid that I would refer under "Rectum, cancer of," to "Sigmoid, cancer of," and *vice versa*. In this way I can find all cases that are allied.

I should refer also to certain encyclopædias, as, for example, Ashhurst's "International Encyclopædia of Surgery," in six volumes ; Buck's "Reference Hand-book of the Medical Sciences," in eight large volumes, and other similar works, of each of which I show you one volume. Specialties also have their encyclopædias, such as those on the eye, the ear, children's diseases, etc. You can always consult these with profit. In addition to these there are the "Transactions" of many societies, as, for example, of the American Surgical Association and the American Orthopædic Association, and so on with many other associations. You should make all of these available by cataloguing their valuable papers in the way I have mentioned. For instance, "Artery, popliteal, perforation of, by a splinter of bone in fracture," is catalogued under "Artery, popliteal, perforation of," etc., and also under "Fracture of femur, perforation of popliteal by a splinter of bone," etc. You thus have not only the fracture of the femur and its result, but also the perforation of the artery and its cause noted. Let me read another, "Artery, renal, aneurism of, nephrectomy, recovery." Under aneurism I would have "Aneurism of renal artery, treatment of, by nephrectomy," and so on. Here is another under C, "Cauda equina, lesions of." Then follow a number of papers on that subject as distinguished from the lesions of the spinal cord. These quotations from my own catalogue are sufficient to show you the method.

Each man knows his own needs, his own tastes, his own practice best. Two such catalogues, one for his own cases and one for journal articles, books, etc., all bearing on the branch of practice he has selected or on all, if he is a general practitioner, will well equip him both as a practitioner and as a writer.

But these catalogues cover only a small portion of the literature of the world. If you wish to consult this, you must do so by larger catalogues than a personal one.

I have here one volume of the "Index Catalogue" of the magnificent library that I have spoken of, that of the Surgeon-General of the United States Army,—an entirely unique literary production of which we as Americans may well be proud. How many medical journals do you suppose there are in the world? Dr. Robert Fletcher has recently said there are nearly eleven hundred, and every article in all these journals as well as all medical books published in all languages are found in this splendid catalogue. It is in sixteen large quarto volumes and covers every subject that can possibly be connected with medicine. The literature of some subjects will cover over one hundred pages. In such extensive subjects it is subdivided into works and articles bearing on the anatomy, pathology, etiology, symptoms, complications, treatment, etc., and if very extensive in its bibliography it is again subdivided very minutely.

We have also another important current index called the "Index Medicus," edited by Dr. Billings and Dr. Fletcher, of which I show you vol. xix. This monthly publication contains the titles of all the medical papers and books in the world for the year. The value of such an index is simply incalculable.

Now, suppose you are going to write a paper, and you have the material from the notes of your own cases (from your first card catalogue), and have read all you need in the books and journal articles (from your second card catalogue), and have supplemented these by reading the articles or books of importance which you have found recorded in the "Index Catalogue" or the "Index Medicus," how will you go about writing your paper ?

First comes the title of the paper or case, and I would advise you to take pains to select a good title. Never use such a title as "Two Interesting Surgical Cases," or "An Unusual Surgical Case," etc. These papers will go in the "Index Medicus" under precisely the title you give, and the titles mentioned give no clue to the nature of the cases you report. Suppose I am hunting up cases of operation for perforation of the intestine in typhoid fever, how can I know that the papers just named refer to just the cases I am seeking for? The fact is that papers with such indefinite titles are probably never consulted. State what you are writing about clearly and tersely; if it be a case, give it a good descriptive name; and if there were any unusual complications deserving attention or any novel procedure employed, state it in the title.

When you want to write your paper and have your title and material, after any introductory or historical remarks, you will first consider the etiology; next the pathology (often these two are intertwined); third, the symptoms; fourth, the physical signs; fifth, the diagnosis; sixth, the differential diagnosis; seventh, the prognosis; and, eighth, the treatment. This plan gives a logical method to your paper. It is often well, also, at the end of a paper to make a summary of your conclusions, so that there may be crystallized from your paper the principal conclusions that you have been led to. Always try to express yourself clearly. Never try to use fine language; write plainly and simply so that anybody may understand it. When I see a paper written by a man whose former papers have been marked by clearness and good sense, I always read it. You soon learn to "size up" the writers of papers and books.

It has been a great pleasure to me, gentlemen, to meet you this evening. I hope I have opened your eyes to the vast fields of medical bibliography in which you may roam at will; have shown you the means, the methods, and the great labor which your teachers and the writers of the books you study and often admire are compelled to undertake and find delight in; have exhibited to you the methods by which you can make your own work and your own reading valuable, because it is properly recorded and then made available by proper indexing; and, above all, have stimulated you to do the best work in your power and to add to your at first scanty knowledge, to the end that you may grow better, wiser, and abler men and make that larger knowledge available for the relief of human suffering and the prolongation of human life.

Bronze statue of Samuel D. Gross in the Smithsonian Park, Washington, D. C.
The building in the background is the Army Medical Museum

ADDRESS AT THE UNVEILING OF THE STATUE OF THE LATE PROFESSOR SAMUEL D. GROSS, M.D., WASHINGTON, D. C., MAY 5, 1897.*

Fellows of the American Surgical Association, Members of the Alumni Association of the Jefferson Medical College, and Friends:

GO with me, your spokesman, to-day to the Woodlands Cemetery,—that "God's Acre" or "Court of Peace," as the Germans so poetically call it,—which holds the dust of so many of the best dead of Philadelphia. Upon an urn there treasured you will read the following:

IN MEMORIAM.

Within this urn lie the ashes of

SAMUEL D. GROSS,

A Master in Surgery.

His life, which neared the extreme limits of the Psalmist, was one unbroken process of laborious years.

He filled chairs in four Medical Colleges, in as many States of the Union, and added lustre to them all.

He recast Surgical Science, as taught in North America, formulated

* Reprinted from the Transactions of the American Surgical Association, 1897.

The statue, in bronze, was erected by the American Surgical Association, the Alumni Association of the Jefferson Medical College and other friends of Professor Gross.

anew its principles, enlarged its domain, added to its art, and imparted fresh impetus to its study.

He composed many Books and among them

A SYSTEM OF SURGERY,

which is read in different tongues, wherever the Healing Art is practised.

With a great intellect, carefully trained and balanced, he aimed with undivided zeal at the noble end of lessening human suffering and lengthening human life, and so rose to the highest position yet attained in science by any of his countrymen.

Resolute in truth, he had no fear; he was both tolerant and charitable.

Living in enlightened fellowship with all laborers in the world of Science, he was greatly honored by the learned in foreign lands, and deeply loved at home.

Behind the Veil of This Life There is a Mystery Which He
Penetrated on the
SIXTH DAY OF MAY, 1884.

HIS MEMORY

Shall exhort and his Example shall encourage and persuade those who come after him to emulate deeds which, great in themselves, were all crowned by the milk-white flower of

A STAINLESS LIFE.

Who and what was the man of whom this was said?

Samuel David Gross was born near Easton, Pennsylvania, July 8, 1805, and died in Philadelphia May 6, 1884, having nearly completed his seventy-ninth year.

His early years, under the wise training of a good mother, to whose memory he rightly pays just tribute, were spent amid the rustic labors and healthful pleasures of a Pennsylvania farm. This gave him a strong and vigorous body, without which he never could have performed a tithe of the labor which pre-eminently distinguished his long life. Before he was six years old he determined to be a surgeon, and early in his professional studies to be a teacher. Yet when he was fifteen he knew scarcely any English. Brought up among the sturdy, honest, laborious Pennsylvania Dutch, he could speak that curious English-German. But his English, of which he became so fluent a master, and even pure German, which he began to study at the same time, were learned almost as foreign tongues and as a result of his appreciation at that early age of his need for a better and wider education. Even a still more striking evidence of the early development of the innate strength of his character and indomitable will is a story told in his autobiography. While a boy he became expert in playing cards; but finding that he was becoming so much fascinated by them that he replayed his games in his dreams, he resolved—fancy this in a boy not yet fourteen!—to abstain from the game for twenty years—a vow he religiously fulfilled.

At seventeen he began the study of medicine as the private pupil of a country practitioner, but after learning some osteology with the aid of that tuppenny little compend, Fyfe's "Anatomy," and a skeleton, he gave up in despair, for again he found his intellectual tools unequal to his work. The little Latin he had was insufficient, and to understand the technicalities of medicine, Greek was a *sine qua non*. "This," he says, "was the turning-point of my life. . . . I had made a great discovery—a knowledge of my ignorance, and with it came a solemn determination to remedy it." Accordingly he stopped at once in his medical career and went to an academy at Wilkes-Barre. He studied especially Latin and Greek, the latter by the use of Schrevelius's lexicon, in which all the definitions were in Latin, and Ross's grammar, constructed on the same principle. But to a master will like his such obstacles were not insuperable. To Greek and Latin, English and German, later years added also a knowledge of French and Italian.

At nineteen he began the study of medicine again—a study in which for sixty years his labors never for a moment ceased or even relaxed.

In 1828, at the age of twenty-three, he took his degree in the third class which was graduated from the Jefferson Medical College. He opened an office first in Philadelphia, but soon removed to Easton. Nothing is more characteristic of the man than that, while waiting for practice, he spent hours daily in dissecting in a building he erected at the back of his garden, and provided himself with a subject by driving in a buggy all the way from Easton to Philadelphia and back with this gruesome companion; wrote a work on descriptive anatomy, which, however, he never published, and in eighteen months after graduation had translated and published Bayle and Hollard's "General Anatomy"; Hatin's "Obstetrics"; Hildebrand on "Typhus," and Tavernier's "Operative Surgery"—works aggregating over eleven hundred pages. His motto was indeed "*Nulla dies sine linea.*" His "stimulus" he himself says "was his ambition and his poverty."

In 1833, five years after his graduation, he entered upon his career as a teacher—a career which continued for forty-nine years, until within two years of his death. This took him first to Cincinnati as Demonstrator of Anatomy in the Medical College of Ohio. Those of my audience who left Cincinnati yesterday will be amused to learn that by stage, canal, and primitive steamboat, it took him thirteen days to reach the Queen City; and all of you will admire the pluck and courage of the young man when I add that his total worldly goods on reaching there were one hundred dollars in his purse, a wife and two children in his family, but also in his breast a heart ready to grapple with any difficulties and a determination to conquer them all.

In 1835 he became Professor of Pathological Anatomy in the Cincinnati Medical College, where he was a colleague of Daniel Drake, Willard Parker, and James B. Rogers, one of the famous four brothers, with a second of whom—Robert E.—he was later a colleague in the Jefferson.

His book on "Bones and Joints" had appeared in 1830, and next, as a result of four years' study and teaching, his "Elements of Pathological Anatomy" was published in 1839. It is strange to think that in a then small Western town in America a young teacher in a new medical school should have published the first book in the English language on pathological anatomy. No wonder, then, that it brought him fame and practice; that its second edition made him a member of the Imperial-Royal Society in Vienna; and that, thirty years afterward, Virchow, at a dinner he gave to its then distinguished author, should show it as one of the prizes of his library.

In 1840 he went to the University of Louisville as Professor of Surgery, and, excepting one year when he was Professor of Surgery in the University of the City of New York, he remained there for sixteen years, happy in his family, his students, his flowers, and his generous hospitality. He and his colleagues—Drake and Austin Flint—soon made it the most important medical centre in the West, and he was in surgery the reigning sovereign. While there he published, in 1851, his work on the "Urinary Organs," and in 1854 another pioneer work, that on "Foreign Bodies in the Air-passages." His fame had become so great that he was invited to the University of Virginia, the University of Louisiana, the University of Pennsylvania, and other schools. But he was steadfast to Louisville until his beloved Alma Mater called him to the chair just vacated by Mütter. From 1856, when in his Introductory he said, "whatever of life and of health and of strength remain to me I hereby, in the presence of Almighty God and of this large assemblage, dedicate to the cause of my Alma Mater, to the interest of medical science, and to the good of my fellow-creatures," until he resigned his chair in 1882—nay, until his death in 1884—this was absolutely true. Even when the shadows of death were thickening he corrected the proof-sheets of two papers on "Wounds of the Intestines" and "Lacerations Consequent upon Parturition," his last labors in the service of science and humanity.

Three years after he entered upon his duties at the Jefferson he published his splendid "System of Surgery"—a work which, though in many respects its pathology and its practice are now obsolete, is a mine of information, a monument of untiring labor, a text-book worthy of its author, and one which has been the companion and guide of many generations of students. It was translated into several foreign tongues and passed through six editions, the last appearing only seventeen months before his death. That even when verging upon fourscore he should have been willing to throw aside all his strong prejudices and accept the then struggling principles and practice of Listerism shows the progressive character of his mind and his remarkable willingness to welcome new truths.

From his removal to Philadelphia until his death, twenty-eight years later, his life can be summed up in a few sentences: daily labor in his profession, editorial labor without cessation for some years in managing the "North American Medico-Chirurgical Review," the successor of the Louisville "Medical Review," of which he had also been the editor; article after article in journals; address after address; twenty-six annual courses of lectures on surgery to thousands of students; labors without ceasing until he wrapped the drapery of his couch around him and calmly passed away.

In reviewing his life we may fittingly consider it from the standpoint of the surgeon, the author, the teacher, and the man.

As a surgeon he was painstaking, thorough, and careful in his investigation of a case, skillful as an operator, and, having so vast an experience and equally extensive acquaintance with the wide literature of his profession, he was scarcely ever perplexed by the most difficult case and rarely at a loss as to the proper course to pursue in the most unexpected emergencies.

He was a practitioner of the old school, who always mingled medicine with surgery, and attributed much of his success in the latter to his experience in the former. In theory he sometimes clung to beliefs, which, in practice, he abandoned. In one of his later papers, "A Lost Art," and in his lectures, he still advocated bloodletting; but in the nearly twenty years in which as a student, an assistant in his clinic, and a quiz-master I saw much of his practice I only remember two cases in which he actually bled his patients.

His influence on the profession was marked and wholesome. For many years he was almost always at the annual meetings of the American Medical Association and the American Surgical Association, was looked up to in both as the Nestor of the profession, and his papers and his wise words of counsel moulded both the thought and the action of his brethren to a notable degree. He founded two medical journals, was the founder of the Pathological Society of Philadelphia and of the Philadelphia Academy of Surgery, the founder and first president of the American Surgical Association, and the first president of the Alumni Association of the Jefferson Medical College. It is peculiarly fitting, therefore, that these last two associations should unite to-day in erecting and unveiling the bronze statue of one who did so much for them and whom they rightly delight to honor. All who knew his tall, manly figure and his fine face will agree that it is a speaking likeness, both in pose and feature. Could I only get a glimpse of the right hand which holds his familiar scalpel I would recognize the man. *Ex pede Herculem! Ex manu Gross!*

As an author, his chief characteristics were untiring industry, comprehensiveness, methodical treatment of his subject, and a singular felicity of style, especially for one who acquired English so late and with difficulty. In fact, through life his speech, by a slight, though not unpleasant, accent, always betrayed his German descent.

He "blazed" more than one new "trail" in the forests of surgical ignorance. In the early part, and even in the middle of this century, it was rare for Americans to write medical books. The most they did was either to translate a French or a German work or to annotate an English one. He was one of the earliest to create an American medical literature of importance, and his works on the "Urinary Organs," on "Foreign Bodies in the Air-passages," and his text-book on "Surgery" gave a position to American surgery abroad which we can now hardly appreciate; while, as already related, his "Pathological Anatomy" was the very first work in the English language on that most important branch of medicine.

His experiments and monograph on "Wounds of the Intestines" laid the foundation for the later studies of Parkes, Senn, and other American surgeons, and have led to the modern rational and successful treatment of these then so uniformly fatal injuries. He first advocated abdominal section in rupture of the bladder, the use of adhesive plaster in fractures of the legs, amputation in senile gangrene, and the immediate uniting of tendon to tendon when they were divided in an incised wound. Had he lived but a year or two longer bacteriology would have shown him that scrofula was of tuberculous origin, and not, as he so firmly believed and vigorously taught, a manifestation of hereditary syphilis.

That his eminence as an author should have met with recognition from scientific organizations and institutions of learning is no cause of surprise. It made him the president of the International Medical Congress of 1876, a member of many of the scientific societies of Europe as well as of America, and won for him the LL.D. of the University of Pennsylvania, and I believe the unique honor in America of having had conferred upon him the highest degree of all three of the leading universities of Great Britain—Oxford, Cambridge, and Edinburgh. Indeed, it is both significant and pathetic to note that he laid down his pen just after recording in his autobiography the announcement of the honor which the University of Edinburgh intended to bestow upon him at its tercentenary celebration.

As a teacher, I can speak both with personal knowledge and enthusiasm. I can see his tall, stately form, his handsome face, his glowing features, his impressive gestures. He was earnestness itself. Filled to overflowing with his subject, his one desire was to impart to us as much of the knowledge he possessed as our young heads could hold. Repetition did not blunt the novelty nor time lessen the attraction of his theme. It always seemed as if he were telling us for the first time the new story of the beneficent work that surgery could do for the injured and the suffering. His whole heart was in his work. Especially did he inculcate the principles of surgery, for he was convinced, and rightly, that one who was thoroughly imbued with these could not go far wrong in his practice.

His own statement of one of the qualifications of a teacher is so true, yet so often forgotten, that, in spite of its mixed metaphor, I will quote it: "A teacher should be bold and decided in his opinions; not too positive, but sufficiently so to be authoritative. The student cannot judge for himself. The knowledge that is placed before him must be, so to speak, well digested for him." His sense of the heavy responsibility of the teacher is well shown by the following from his autobiography: "Nothing was more offensive to me than applause as I entered the amphitheatre, and I never permitted it after the first lecture. I always said, 'Gentlemen, such a noise is more befitting a theatre or a circus than a temple dedicated not to Æsculapius, but to Almighty God, for the study of disease and accident, and your preparation for the great duties of your profession. There is something awfully solemn in a profession which deals with life and death, and I desire, at the very threshold of this course of lectures, to impress upon your minds its sacred and responsible character, that you may be induced to make the best possible use of your time, and conduct yourselves in a manner worthy of the dignity of Christian gentlemen.' "

The value of recitations in a medical course I fully appreciate and indorse. They will occupy in the future a much larger place in our medical schools than they now do. But I am equally convinced that such a voice, such a presence, such an impressive, earnest lecturer will never lose their powerful influence nor their place in instruction.

As a man, he was beautiful in his relations with his family, who were devoted to him with an affection that was unusually strong; upright in all his dealings, and despising cant and pretense and anything unworthy a true gentleman. Few men were more widely known in and out of the profession, and few ever had the good fortune to know intimately so many distinguished people of both continents. Wherever he was known he was respected, and by those who knew him intimately he was beloved.

Such, then, was the man whom we are gathered to-day to honor. The American Surgical Association, the Alumni Association of the Jefferson Medical College, and a few friends who have gladly united with us in this service of affectionate remembrance, have presented his statue to the people of the United States, to stand forever in our beautiful capital city as a mute, yet eloquent, evidence of our esteem for his personal worth and his professional attainments.

It is strange that the human race has failed so grievously to recognize publicly its great medical benefactors. Mr. Lecky, in his last remarkable book, in speaking of the rewards of genius in Great Britain, after enumerating the chief of the extraordinary and beneficent achievements of medical men in the present century, says, "England may justly claim a foremost place in this noble work, and many of her finest intellects have been enlisted in its service. In no single instance has this kind of eminence been recognized by a peerage. It is clearly understood that another and a lower dignity is the stamp of honor which the State accords to the very highest eminence in medicine and surgery—as if to show in the clearest light how inferior in its eyes are the professions which do most to mitigate the great sum of human agony to the professions which talk and quarrel and kill."* And yet Jenner almost saved England from extinction, and Simpson and Lister have done far more to mitigate the terrors of surgery and the pangs of maternity, to save life, and to bring health and happiness to the human race than Marlborough and Wellington and Nelson have done to destroy life and to bring sorrow and pain, rapine and misery.

It is pleasant to record that with the opening of this year, England has atoned for such long-continued neglect. In making Sir Joseph Lister the first medical peer she has conferred less honor upon Lord Lister than upon herself.

The statue of Marion Sims, not long since erected in New York, and this of Samuel D. Gross, let us hope, are the beginning of a similar recognition of beneficent genius in our own land. Go through the broad streets of this beautiful city, and in its circles and parks and squares you will find, with singular exceptions, only the statues of statesmen and warriors—men who deserve, we all agree, their well-won honors and immortality. But, truly, "Peace hath her victories no less renowned than those of war." Though its heroes are not, it may be, portrayed in marble or bronze, they are enshrined in the grateful hearts of mankind, immortal in literature, even the humblest of such toilers as the Gideon Grays and the Weellum Maclures that cheer and brighten the world.

And were the soldiers, whose statues one may see everywhere around us, the sole possessors of bravery? In 1832, that most dreaded of all scourges, Asiatic cholera, for the first time broke out all over this country with the greatest

* Democracy and Liberty, i, 429.

virulence. Easton was only eighty miles from New York and the citizens, in terror lest the dread disease would reach their own town, appointed a young, intrepid surgeon to visit New York and learn what he could for their benefit. When others were fleeing in frightened thousands from the pestilence Gross bravely went directly into the very midst of it, reaching New York when the epidemic was at its very height. In that then small and half-depopulated town 385 persons died on the very day of his arrival—and he stayed there a week in a hot July, visiting only its hospitals and its charnel-houses. What call you that but the highest type of bravery? —a bravery which Norfolk and Mobile and Memphis have since seen repeated by scores of courageous physicians ready to sacrifice their lives for their fellow-men with no blare of trumpets, no roar of cannon, no cheer of troops, no plaudits of the press! No battlefield ever saw greater heroes; no country braver men!

Yonder statue of Joseph Henry has stood alone for too many years. We have to-day unveiled its worthy companion. Both of them are memorials of men great in science, whose lives were devoted to the good of their fellow-creatures, to saving life, adding to human comfort, lessening pain, promoting knowledge, cheering the sick, and assuaging even the very pangs of the dying. We do well thus to honor in imperishable bronze the men who have won these victories of peace! To no one can the words of the blessed Master apply with greater force than to the kind surgeon whose time and thought and talents are given to humanity, and, above all to the poor, with no payment but the grateful look of returning health and rescued life and that inward satisfaction which far surpasses all the wealth of the Orient. "Inasmuch as ye have done it unto one of the least of these my brethren ye have done it unto Me."

SEMICENTENNIAL ADDRESS IN SURGERY.*

MR. PRESIDENT AND GENTLEMEN OF THE AMERICAN MEDICAL ASSOCIATION:

IT is always proper to acknowledge an honor, but when it comes unsolicited from so large and distinguished a body of men, representative of the entire profession in the United States, and on an exceptional occasion, I feel it a double honor to have been chosen to deliver the Semicentennial Address in Surgery. I beg to return you my very hearty thanks for your extreme kindness.

As we celebrate on this occasion the Semicentennial of the organization of the American Medical Association, in this city, in 1847, it is very natural and proper that the Address in Surgery should be a review of the work done in the last fifty years, and, by contrasting the state of surgery and of surgical teaching in 1847 with that which exists in 1897, to see what progress has been made. To recount what has been achieved in these "fifty years of science" far better than a "cycle of Cathay" is not only a pleasure, but it is an immense incentive, since by the progress made in the last fifty years we can in some measure anticipate the enormous, and probably even still greater progress, that will be made in the next half-century.

The time, also, is opportune. Last year was celebrated the centennial of vaccination and the semicentennial of the first public administration of ether. Sydney Smith's bitter

* Delivered at the Semicentennial Meeting of the American Medical Association at Philadelphia, Pa., June 3, 1897. Reprinted from the Journal of the American Medical Association, June 12, 1897.

query in 1820, "In the four quarters of the globe, who reads an American book, . . . what does the world yet owe to American physicians or surgeons?" was answered a quarter of a century later and made all these "four quarters of the globe" our grateful and everlasting debtors for the gift of anæsthesia. It was the discovery of an American dentist, was first used by an American surgeon, was christened by an American physician and littérateur, and the recent celebration awakened throughout the world the interest not only of the profession, but also of the entire public. The strains of our still living poet, novelist, physiologist, and, as we all best love to remember him, neurologist, Dr. S. Weir Mitchell,—*nihil tetigit quod non ornavit,*—as he sung of the "Birth and Death of Pain," have scarce died away before we begin anew our round of celebrations in the anniversary of this now almost venerable association.

A most important factor in the improvement not only in surgery, but also in all departments of medicine, has been the immense advance made in *Medical Teaching*. The educational plane of the profession has been steadily elevated. If the teachers of fifty years ago were to revisit the scenes of their early labors they would scarcely recognize the medical colleges in which, in their day and generation and with the meagre appliances then at their command, they did what we must still recognize as yeoman's work in education. Apparently, at that time, the entire instruction consisted in lectures, no text-books even being advised. In reply to a letter addressed to the deans of the Jefferson Medical College and of the Medical Departments of the University of Pennsylvania, Harvard University, and Columbia University, I am told that no lists of text-books whatever appear on the catalogues of fifty years ago. In the "catalogue" of the Jefferson for 1857—a mere catalogue of names of the faculty and students, instead of the present elaborate "Announcement"—for the first time appears a list of "Books of Reference," and the Dean of Harvard states that there "the first mention whatever made of text-books appears in the announcement of the summer session, beginning March 12, 1866," four years after I graduated! At first the text-books generally recommended on surgery were Drewitt and Erichsen; Malgaigne and *Pancoast** on "Operative Surgery," and, for collateral reading, Brodie and Holmes.

The course of didactic lectures then began on the second Monday of October and ended soon after the middle of February, and if we take out the holidays, and remember that not a few made up for coming late by leaving early, it was quite a possibility for a man to receive his authorization to practice, a diploma which alleged him to be "*Virum probum in arte medica, æque ac chirurgica . . . dignum amplissimis honoribus academicis,*" after practically only two sessions of little more than three months each! The examination was a farce and the diploma a falsehood. Even so late as 1860, when I began the study of medicine, there were no laboratories, except that of anatomy—the dissecting-room. I doubt whether of the two hundred and odd men who graduated with me in 1862, 10 per cent. had ever looked through a microscope or handled a test-tube, palpated a tumor, or auscultated a chest. There were no recitations; neither were there ward classes nor other means for actual contact of the student with disease. We can but wonder that any of us who graduated in the first twenty years of the half-century we are celebrating ever learned enough to prevent some from being rivals to Saul, who had slain his thousands, and the more nimble from rivalling David, who slew his ten thousands. That we have become respectable practitioners, or possibly more than respectable, is due not so

* The names of American surgeons are printed in italics, to point out more distinctly some of those Americans who have aided in the development of surgery. The limits of the address only allowed me to name a few, and I must apologize for all the necessary omissions.

much to our early opportunities as to later incessant midnight labors.

Now we may congratulate ourselves that the majority of the Medical Schools of the country have a graded course of four years, each covering not less than six, and often eight months; not only lectures, but in many instances constant and searching recitations; a dozen laboratories in which each student actually does the work of observation and experiment; ward classes in which every man is obliged to train his eyes, his ears, his fingers, and his judgment in the examination of patients in every department of medicine; to ferret out the history of the cases brought before him, ascertain symptoms, seek for physical signs, reach a diagnosis, determine the treatment, and often actually to prescribe and to assist at operations.

Not only, however, is the advance marked in our medical schools, whose diploma now really means almost what it says, but also all over the land since 1847 there have been established, partly from philanthropic motives and partly for the purpose of medical teaching, an enormous number of *Hospitals*, in which a very large proportion of the young men, after receiving their diplomas, spend a year or more in the actual practice of their profession, under the eyes of accomplished teachers. It is impossible to describe the immense benefit thus obtained by large numbers of nascent practitioners, from such familiarity with all the phases of disease which they will meet in their after-lives. Not a few of them also, by being brought in contact with energetic, enthusiastic, and wise teachers, receive their first stimulus, both literary and scientific, a stimulus which will influence their entire future course, and is of far more value than any amount of mere scientific knowledge they may acquire.

What untold good these hospitals do, not merely to the patients who are cured and the internes who are taught, but equally to the older medical staff who are still further trained and educated by them! Not only in great metropolitan centres, but in small towns, and sometimes even in rural communities, this growth of hospitals has been within the last twenty years one of the striking features of our civilization. It is not too much to say that every city or town establishing a hospital is repaid a hundredfold by the immediate improvement of its medical men from those opportunities for experience and exact study. No one can visit a modern hospital without being struck by the immense improvements of the last few years. The noisome hotbeds of contagion, of fever, of suppuration, of erysipelas, of blood-poisoning, and of "hospital" gangrene—could irony wield a sharper weapon than such a name?—have given way to neat and trim wards, the home of cleanliness itself, with iron bedsteads, glass-topped tables, cement or marble, tiled or tesselated floors and walls, with trained nurses whose jaunty caps and pretty uniforms and often winsome faces almost make one half wish to be sick, and when one is sick half loth to be well.

I mentioned a moment ago the *Text-books* in use forty years ago. Except *Pancoast's* "Operative Surgery," every one of them, it will be observed, was the work of a European. *Gross's* "System of Surgery," which has probably had a wider influence in educating the profession than any other general surgical text-book issued up to the present time—a monument of surgical knowledge and indefatigable labor—was first published in 1859. This was far in advance of most of the surgical text-books then in use. The literary labors of American surgeons consisted chiefly in translating foreign surgeries or in annotating American editions of English text-books.

Within the last two decades, and especially the last, we all know, without my undertaking the invidious task of naming them, how many distinctly American surgeries have been written, and we may say, without undue national vanity, that they are the equals of any similar European works. This literary and scientific activity, however, has not been limited to text-books or systems of surgery alone, but our forward strides in education have been marked by the appearance of not a few monographs of original research which do credit not only to their authors, but to all American surgeons.

On more than one occasion I have had to call attention to the difference between American surgery and that of Europe. While in the department of the practice of surgery, after a full acquaintance and observation with European men and methods, I can state my deliberate conclusion that the best American surgeons are the peers of the best European surgeons; yet in the department of original research and especially of *laboratory work*, we must confess our very evident shortcomings. I do not say that we should be ashamed of them, for we must remember that we are but little more than a century old as a nation; that the practical needs of everyday life must first be met; that opportunities must be created by the construction and endowment of laboratories, and especially by the growth of that literary and scientific spirit which only develops in any community or profession in the course of long years and with accumulated wealth, and which has had little opportunity for growth in this country until within the last twenty years. The genius of our institutions is such that we can never look for government or State endowments of such laboratories, but must depend on the far-sighted and broad-minded liberality of our wealthy fellow-citizens for the establishment of such laboratories and the consequent opportunities for investigation and discovery. Nor do I believe, in the long run, that we shall suffer by reason of this difference. As a people we are not apt to be left behind in the race, and the stimulus of a somewhat exceptional distinction in science or literature will meet with a responsive chord in the breast of many a young man now beginning his studies.

To attempt to impress upon the members of the American

Medical Association the need for such original research in this country is a work of supererogation, but I may with propriety urge you with all the ardent and intense conviction I feel, that as we leave this festal meeting and go to our homes, everyone of us as occasion offers will urge upon our wealthy liberal-minded fellow-citizens the duty and also the privilege of founding in connection with every medical school laboratories of research, the good influence and beneficent results of which can never be estimated in paltry dollars and cents. Yet tried even by this commercial standard science pays. The early recognition of the germs of cholera at the port of New York some years ago by preventing the entrance of such a commerce-destroying epidemic, leaving wholly out of consideration the saving of human life, saved to the citizens of the metropolis more millions of dollars than are represented many times over by the cost of all the laboratories now existing in this country. Our merchants should be made to understand, therefore, that even from a financial point of view, to say nothing of the humanitarian standpoint, the cheapest means of preventing the enormous business losses which occur from epidemics is by such scientific and hygienic measures as the laboratory makes possible.

Allied to medical teaching and the most important adjunct to medical literature is the establishment of extensive *Medical Libraries.* In this, as an American, I am proud of my own country. No foreign nation can point with equal pride to any such medical libraries as the last thirty years have developed in this country. Foremost, not only among American libraries, but in the world, is that of the Surgeon-General's Office of the United States Army in Washington. Not only has it gathered thousands of medical books and eleven hundred medical journals (the estimate of Dr. Fletcher) from all over the world, but the entire library is managed with a liberality which makes it the admiration and the envy of foreigners. Its treasures are freely at the service of the entire profession of the country, and the publication (under the editorship of *Dr. John S. Billings*) of its magnificent "Index Catalogue," has made the whole world debtors to America. We trust that a more liberal congress may see that if even the small amounts thus far given to it have made it of such immense value, still larger and more generous appropriations would keep it ever in the van.

In addition to this, the libraries of the College of Physicians of Philadelphia, of the New York Academy of Medicine, and of the Boston Medical Library Association are only surpassed by those of the faculties of medicine in Paris, of the Royal College of Surgeons of London, and of the Military Medical Institute of St. Petersburg; while those of the Newberry Library in Chicago (thanks to our honored and liberal president), of the New York Hospital, and of the Pennsylvania Hospital rank well with the best European libraries. With such literary opportunities, therefore, if we had equally good scientific laboratories the possibilities of American medicine and surgery would be almost unbounded.

The scientific progress of this half-century of surgery has separated as from the past as by a great gulf. Great theologians, such as a Calvin or a Jonathan Edwards, were they recalled to life, could discourse as learnedly as ever of Predestination and Free Will; great preachers, as a Beecher or a Spurgeon, could stir our souls and warm our hearts as of old; great jurists, as a Justinian or a Marshall, could expound the same principles of law which hold good for all time; great forensic orators, as a Burke or a Webster, could convince us by the same arguments and arouse us by the same invectives or the same eloquence that made our fathers willing captives to their silver tongues. But to-day, so rapid has been our surgical progress, a Velpeau, a Sir William Ferguson, or a *Pancoast*, all of whom have died within the last thirty years, could *not* teach modern surgical principles nor perform a modern surgical operation. Even our everyday surgical vocabulary—staphylococcus, streptococcus, infection, immunity, antisepsis and asepsis, toxine and antitoxine—would be unintelligible jargon to him; and our modern operations on the brain, the chest, the abdomen, and the pelvis would make him wonder whether we had not lost our senses, until seeing the almost uniform and almost painless recoveries, he would thank God for the magnificent progress of the last half-century, which had vouchsafed such magical—nay, such almost divine—power to the modern surgeon.

The splendid "Index Catalogue of the Library of the Surgeon-General's Office" teaches another lesson. In law, the jurist or attorney deals with statutes and precedents, and to some extent with principles which are for the most part local. An American lawyer could not plead a case in Germany, nor a German lawyer in Russia, nor a Russian lawyer in Italy. Laws and customs differ from country to country. An American or an English divine is an alien in language and religion in Hindustan; a Hindu, equally an alien in China; a Chinaman, in Africa. But surgery is one and the same the world over. Whether in the frozen north or under the equator, in civilized America or barbaric Africa, be the patient white Caucasian, swarthy negro, red Indian, or yellow Malay, the same accidents and diseases assail him, the same remedies save him, identical operations cure him: a new remedy discovered in Japan is equally efficacious in Philadelphia; a new operation devised in America is equally applicable in Egypt. The "Index Catalogue," which is a catalogue not for one country, but for all nations and all tongues, contains them all. This, with our noble stand as a profession against patenting any instrument, any operation, or any method of treatment, makes every sick or injured man my brother, and makes me his keeper, under every sky, and clothed in any skin. Heaven bless such a divine profession, such a noble array of generous men battling for the life and health of all mankind, the world over, in one serried phalanx of unselfish heroes!

The development of modern surgery, apart from surgical teaching, libraries and laboratories, is dependent on several noteworthy factors. These have to do partly with the discovery and development of surgical principles, and partly with the development of surgical practice. Now the one and now the other is in advance. Each is the handmaid of the other. In Listerism we see surgical practice outstripping surgical principles, for of Lister it might truly be said, that by the "scientific use of the imagination" he saw the germs, "when as yet there were none of them." His surgical insight convinced him of the existence of the germs of suppuration years before Ogston's and Rosenbaum's discovery of the pyogenic organisms. On the other hand, the moment that the scientist discovered these germs, the laboratory enabled him to discover many others, and the discovery of the bacillus of tetanus, of the tubercle bacillus, of the streptococcus of erysipelas, of the gonococcus, of the bacillus of malignant œdema, the bacillus mallei, etc., illustrate the converse—science forging ahead of practice, and pointing the way to new achievements in the healing art.

First.—Foremost among the important studies which the past fifty years have seen established on a firm foundation, is that of *Pathology and Pathological Anatomy.* It is not a little credit to America that the first pathology written in the English language was written by a young American doctor, in a then small Western town, as early as 1839. In spite of Gross's book, however, pathology and pathological anatomy were almost unknown sciences in 1847. The Pathological Society of Dublin was founded in 1839, that of New York in 1844, that of London in 1846, and that of Philadelphia in 1857. The microscope, and especially microscopical methods of staining, section cutting, and the like were in their infancy, or may indeed be said scarcely to have existed. No accurate views of pathology could be entertained without these aids. What is now the heritage of every first year student was beyond the possibilities of the most advanced teacher of fifty years ago.

Second.—Allied sciences have been put under tribute to surgery. In physics the discovery of the *Roentgen rays* is so recent as to require only mention. This discovery, as well as the enormous advances of *Electricity*, as seen in the electric headlight, the cystoscope, the gastro-diaphanoscope, and other means of diagnosis, engenders the hope that other forces and other means of investigation quite as surprising and quite as marvelous, are certainly to be expected within the next fifty years.

It is due, however, especially to the development of *Embryology* and *Comparative Anatomy*, in combination with pathology, that our views of the nature of disease have become so much more accurate. Perhaps the book which then influenced surgical views and surgical practice more than any other was Chelius's* "Surgery," of which a translation by South was republished in Philadelphia in 1847. It had passed through six editions, and had appeared in eight languages. It may be taken, therefore, as the type of the most advanced European surgery of that day. How curiously vague his ideas of pathology were may be seen in his classifying together false joints, old rupture of the female perineum, harelip and cleft palate, as "old" in contradistinction to "recent," "solutions of continuity which do not suppurate." Though he speaks of the last two as "original vices," yet so far as concerned embryology, which has shown the cause for harelip and cleft palate, he is absolutely silent. Stenosis of the œsophagus, of the rectum, of the prepuce, urethra, and vagina, were all classed together under "diseases of unnatural adhesions of parts." The existence of neoplasms as a cause of the stenosis was not clearly differentiated from other causes. All his ideas as to tumors were vague, and, as we now know, wholly unscientific. There is no chapter on

* Professor of Surgery at Heidelberg.

tumors in the modern sense, though there is one on "diseases which consist in the degeneration of organic parts, or in the production of new structures"; but even in this, enlarged clitoris, goitre, warts, bunions, fungus of the dura mater, fatty swellings, encysted swellings, and loose bodies in the joints are grouped with polyps, sarcoma, cancer, and other new growths. Ranula, retention of urine, and retention of the fetus are classed together as "Foreign bodies formed in our organism by the retention of natural products," and hernia cerebri is treated in connection with all other forms of hernia. Greater disregard of their pathology or etiology, of their origin and significance, can hardly be imagined.

Though John Hunter had dissected over five hundred varieties of animals a half-century before the American Medical Association was organized, yet the solidarity of the animal kingdom from man down to the lowest form of life was not recognized. Evolution, and, therefore, reversion to animal types, was not recognized, and hence not used to explain many abnormal developments. For instance, abnormities in the arch of the aorta and its branches, which we now recognize as variations of a general plan running through the entire animal kingdom, were then mere curiosities of structure without any meaning.

Third.—The year before the American Medical Association was organized the world was startled and surgery revolutionized by the introduction of *Anæsthesia;* first of ether, in America, in the year 1846; then of chloroform, in Edinburgh, in the following year. What this has done for the amelioration of the horrors of pre-anæsthetic surgery very few now living can appreciate. Instead of shrieks, and cries, and groans, and a needful celerity which sometimes became dangerous haste, everything now proceeds with that quiet and leisure which is essential to the performance of many, if not most, of our modern, elaborate, and prolonged surgical operations. Now "the fierce extremity of suffering has been steeped in the waters of oblivion, and the deepest furrow in the knotted brow of agony has been smoothed away forever" (Holmes). Who could possibly endure the tortures of an operation lasting for one, two, or it may be even three hours, when every minute seemed an eternity of agony? I would rather be the discoverer of anæsthesia than have won an Austerlitz or a Waterloo!

The old motto, "*tuto cito et jucunde*," is now changed by the omission of "*cito*." In fact, as has been pointed out by Cheever and a few others, the leisurely performance of operations which is made possible by ether is in danger of leading us to a dilatory method of operating which has its own dangers. Some of our most successful modern surgeons owe not a little of their lessened mortality, I am sure, to their swiftness.

The ideal anæsthetic has not yet been obtained. No one who reads the journals from week to week, and sees the sad headings "Death from Anæsthetics," and especially "Death from Chloroform," can fail to see that both ether and chloroform, and also a few others which occasionally replace them, have very real dangers. The ideal anæsthetic will not be one which will abolish pain without abolishing consciousness. To have the patient aware of surgical emergencies which test even a veteran operator's skill and resources to the utmost would frequently invite death by the terror which it might occasion. The ideal anæsthetic will abolish pain by the abolition of consciousness, *but without danger to life*. That it will be found is as certain as that experiment and progress are our watchwords.

Besides general anæsthesia, several forms of local anæsthesia have been devised, within the last few years, by freezing with salt and ice, rhigolene, or chloride of ethyl, by cocaïne, eucaïne, Schleich's infiltration method, etc., methods which have a distinct sphere of usefulness, especially in minor operations.

Fourth. Antiseptic Surgery.—While the exact date of the revolution in surgery due to anæsthesia can be fixed, a later revolution in our surgical methods came in so gradually that one cannot name any special day, or even year, when it was introduced. But, while the day or year cannot be given, the one man to whom this great revolution in modern surgery is due is well known. The name of Lister, *primus inter pares*, is honored throughout the entire surgical world, and his recent distinction, as the first medical peer of the United Kingdom, is an honor conferred not upon Lord Lister alone, but upon the entire profession, and worthily marks a new departure in the recognition of medical science by the Queen.

So far as this country is concerned, the introduction of antiseptic surgery may be said to date from the visit of Mr. Lister to this same city of Brotherly Love, at the Centennial International Medical Congress of 1876. Derided at first as a "fad" or as "nothing more than surgical cleanliness," it has now won its way over the whole world. A few laggards in the surgical army there are who even yet do not practice modern antiseptic or aseptic surgery, but the overwhelming majority of the profession recognize that the world owes a debt to Lord Lister which no honors can pay. His service to humanity will never be forgotten, and probably never will be surpassed, in its wide-reaching beneficent influence. Anæsthesia abolished pain; antisepsis has almost abolished suppuration, erysipelas, tetanus, and the various forms of blood-poisoning; in other words, nine-tenths of the dangers of surgical operations.

Malgaigne, from 1836 to 1840, lost 126 amputations of the thigh, out of 201, a mortality of nearly 63 per cent.* *Erdman*† has shown that in nine New York hospitals, from 1882 to 1894, the mortality in 223 amputations of the thigh was 21.5 per cent. Heimann‡ reports in Germany, in 1894, 475 cases with a mortality of 21.7 per cent. Page,§ of Newcastle-

* Mütter's Liston, p. 425. † Annals of Surgery, xxii, 1895, p. 358.
‡ Arch. f. klin. Chir., 1897, liv, 223. § Lancet, 1894, i, 1439.

upon-Tyne, has shown that, from 1876 to 1893, of 230 amputations of the thigh, the mortality was only 11.3 per cent.; and *Estes*,* of 77 such amputations, lost only 8, a mortality of but 10.4 per cent. Not a little of this lessened mortality is due to our improved methods of hæmostasis, especially by the use of the hæmostatic forceps, and at the shoulder- and hip-joints by the use of Wyeth's pins.

Without anæsthesia and antisepsis modern surgery would be an impossibility. It is to me an inspiring and encouraging thought that the world owes the three greatest discoveries of modern medicine—Vaccination, Anæsthesia, and Antisepsis—to England and America. Long may we be joined in such scientific brotherhood! Never may we be sundered by fratricidal strife!

Fifth.—As an outgrowth from the practical development of antiseptic surgery has arisen a wholly new science and a wholly new method of practice which bid fair to revolutionize our modern therapeutics—*Bacteriology and Orrhotherapy* (Serum-therapy). Like the antiseptic method, they have been a gradual outgrowth. Modern laboratory research has verified the crude suspicions and shrewd guesses of thirty years ago, and transformed them into the certainties of modern science. The discovery of the anthrax bacillus by Pollender, in 1855; the epoch-making discovery of the pyogenic organisms, in 1881, by Ogston and Rosenbaum; of the tubercle bacillus by Koch, in 1882; of the tetanus bacillus by Nicolaier, in 1887, well illustrate how recent is this scientific knowledge. The splendid results which have been achieved in medicine, by the use of Behring's and Roux's diphtheritic antitoxine, seem to promise that some form of antistreptococcic serum will do as much for surgery, and that your orator fifty years from now will be able to trace the history of the probably soon-to-be-realized method of battling with infection, of which at present we have only a premonition. Bacteriology and orrhotherapy

* N. Y. Med. Rec., Nov. 3, 1894.

are so recent that it is dangerous to prophecy what may occur, but it is not venturing far to predict that fifty years from now we shall be able not only easily to convert infected into non-infected wounds, but also, by some means as yet undiscovered, we shall be able successfully to combat the infection, and prevent the dire ravages of tuberculosis, of syphilis, of cancer, of sarcoma, and possibly even the occurrence of benign tumors. That will be, indeed, the surgical "Golden Age," when surgery will be robbed of nearly all its terrors, when a peaceful victory will abolish our present instruments and the majority of our present operations.

Sixth.—Animal experimentation has had also a very large share in the development of modern surgery. The whole question of the introduction of animal ligatures was begun in America by *Physick*, who used buckskin; his follower, *Dorsey*, who used kid, and cut both ends short; *Hartshorne*, who used parchment, and *Bellenger* and *Eve*, the tendon of the deer; and this has been solved principally by experiments upon animals, in order to determine accurately the behavior of such ligatures in the tissues. Only professional readers can appreciate what a boon to humanity this single achievement has been. Modern cerebral surgery also owes its exactness and success almost wholly to cerebral localization and antisepsis, both of which were first studied by experiment upon animals, and later by the application to man of the knowledge so gained. *Bacteriology would not now exist as a science, nor would accurate modern surgery and a large part of modern medicine be possible, had experiments upon animals been prohibited, as some zoöphilous men and women who love dogs better than men and women and even little children, desire.*

Seventh.—The developments of modern surgery have naturally been on two lines: 1. That of *scientific* progress based especially on pathology, bacteriology, embryology, and comparative anatomy. Our present views of tumors, of malformations, of the theory of immunity, of septicæmia and pyæmia, of thrombosis and embolism, have been the result of the studies by physiologists and pathologists, which have most profoundly helped our practice and influenced our results.

2. Within the last twenty-five years, especially, there has come what might be called pre-eminently the era of the *operative surgeon*, due more especially to the introduction of anæsthesia and later of antisepsis. By making it possible to perform an operation without pain, and almost without danger, organ after organ of the body has been made accessible to the modern surgeon with almost invariable success. Scarcely twenty years ago even Erichsen, in a public address, declared that surgery had nearly reached its final limits, and that the brain, the heart, and the lungs must ever remain inaccessible to the surgeon's knife! But now these organs are so constantly operated on and even removed that I have about reached the conclusion that, with the exception perhaps of the heart, all of our internal organs are strictly to be classed as luxuries—and we even know some heartless people. From this safety and painlessness there has been born an audacity unknown to the men of a former generation. Diseases then thought to be incurable are now vanquished every day in our clinics, and organs thought to be inaccessible are attacked with an impunity which is perfectly marvellous. Indeed, the danger is not slight, that we may go to the other extreme and we may well heed the warning of *Weir Mitchell*, that, perhaps, "surgery has lost much of that keen sense of responsibility which grew out of the larger mortality of other days."

Modern instruments of precision, such as the clinical thermometer, the cystoscope, the ophthalmoscope, the laryngoscope, the otoscope, the proctoscope, the aspirator, etc., without which accurate diagnosis and proper treatment are often impossible; instruments accessory to operation, such as retractors, hæmostatic forceps, transfusion apparatus, etc., without which the modern surgeon would be hampered and hindered beyond measure, were wholly unknown thirty years ago.

Time will not permit me to trace chronologically the introduction of one operation after another. We can best, perhaps, obtain a notion of the difference between the surgery of 1847 and that of 1897 by noting what operations were performed at the former date and contrasting them with present possibilities. Among the operations performed a half-century ago may be included:

Amputations;

The ligation of the most important arteries;

Occasionally excision of joints;

The removal of external tumors;

Lithotomy;

Lithotrity;

Colostomy;

Herniotomy;

Tracheotomy;

Tenotomy (the subcutaneous performance of which, together with the difference in the danger of open and closed fractures, should have pointed out the road to antiseptic surgery long before the day of Lister); and

Trephining, which, though formerly very frequent, had almost fallen into desuetude. South says in 1847, "the less done as regards fractures of the skull, the better. They should never be interfered with except compression be present." The barbarous écraseur and the equally barbarous Jarvis adjuster, were then in frequent use.

Ovariotomy was more than looked at askance, though it originated with McDowell in Kentucky as long ago as 1809. In 1846, *Mütter,* in commending Liston* for protesting against ovariotomy, says: "It is certainly hazarding but little to assert that in a very few years the measure will be assigned to

* Mütter's Liston, p. 442.

the oblivion it so richly merits," and so late as 1862, the year that I graduated, I heard the then Professor of Obstetrics (Meigs) in the Jefferson College, in his last course of lectures, declare with a warmth which did more credit to his humanity than to his science, "that the men who go about the country ripping open women's bellies should be indicted for murder." The first ovariotomy in England was performed in 1836; the first in France in 1844; but for Europe ovariotomy "was not fully established as a surgical procedure until after 1858, when Sir Spencer Wells took it up" *; and in this country, when the brothers *Atlee* at about the same date suffered, one may say even persecution, because of their adherence to their belief that ovariotomy was a justifiable operation. Now, a number of surgeons each can count more than one thousand ovariotomies, perhaps some even two thousand, with a mortality in their later results as low as three per cent.

It is impossible, in the time allotted me, to do more than make a very brief survey of the surgery of 1897, as contrasted with that of 1847, but even a hasty glance will give us some idea of how far we have gone on the road of progress.

One of the most striking departments in which progress has been made is in that of the nervous system. In this, *Mitchell*, though not a surgeon, has suggested many surgical advances. I have already quoted South's dictum as to fractures of the skull—a dictum which is now violated with the happiest results by almost every surgeon in the land. In addition to this, a very large number of tumors of the brain have been successfully removed, tumors which before 1884 were considered as wholly outside the domain of surgery. To our British brethren, Godlee, Horsley, and Macewen, above all others, is due the credit of establishing cerebral surgery on a firm basis of right principles and successful technic.

In abscess of the brain we have a lesion which is still more

* Heath's Hunterian Oration, 1897.

amenable to treatment, and the number of recoveries now mounts even into the hundreds. We have recognized that these abscesses very frequently arise from chronic disease of the middle ear, and, thanks to the otologist, we can now, by proper treatment, in many cases do better than operate on these abscesses—we can prevent them. The papers of Arbuthnot Lane, Ballance, and Macewen have taught us that even so formidable a disease as thrombosis of the sinuses, especially of the sigmoid sinus, can be dealt with successfully. Even the ventricles of the brain have been successfully invaded, drained, packed with gauze, and washed out from side to side.

Tumors of the spine, since Mr. Horsley's brilliant paper, in 1888, have been proved accessible to the modern surgeon. Though *Abbe's* division of the posterior nerve roots, in cases of intractable neuralgia, has not been followed by all the success we could wish, it has proved that the operation is a practicable one. Although, in the words of the hymn, we have not yet "stretched every nerve," we have almost realized that pious exhortation. Section of nerves by accident or deliberately, in the removal of tumors, was formerly followed by permanent paralysis, but now nerve suture has rescued many a poor sufferer and restored the function of the divided nerve, even after months of paralysis. Facial neuralgia, once the bane of the surgeon and the sufferer, has now been cured in a number of cases, not only by the removal of the rebellious nerve, but, as was suggested by *Mears* in 1884,* even the Gasserian ganglion itself has been removed in more than a hundred cases. In this department the names of our American brethren—*Carnochan, Pancoast,* and *Hartley*—stand pre-eminent.

In diseases of the organs of locomotion—the bones and the muscles—the expansion of modern surgical technic has been very marked. The plastic surgery of the bones seems scarcely

* Trans. Amer. Surg. Assoc., 1884, pp. 482, 483.

to have any limit. Osteotomy is so safe that in 1884 Macewen reported 1267 operations, on 704 patients, with only 5 deaths, and these were chiefly due to causes other than the operation. Tenotomy and transplantation of tendons have assumed a new field of usefulness undreamed of a few years ago. In fractures and dislocations the progress has been equally extraordinary. Jarvis's adjuster has given way to the method of manipulation first introduced by *Reid*, and reduced to a science by *Bigelow* and *Allis*, for the hip, and Kocher, for the shoulder, and in a combination of fracture with dislocation the ingenious hook of *McBurney* has enabled the surgeon, in many cases, to accomplish that which manipulation alone could not have done. The splints of *Nathan R. Smith* and *Hodgen*, and the introduction of adhesive plaster by *Gross*, and the subsequent application by this means of the weight and pulley by *Buck*, have supplanted the clumsy splint of Desault. Even so simple a means of treatment as that by plaster of Paris, together with the thorough disinfection of compound fractures, has enabled us to obtain results, either by the recumbent or the ambulatory treatment, which, but a few years ago, were impossible. Compound fractures, then among the most serious accidents of the human frame, with a mortality of about two out of every three, have so lost all their dangers that the mortality is hardly more than two out of every hundred.

Tumors, once too formidable either by reason of their size, their location, their adhesions, or the hæmorrhage which attended their removal, have been made wholly amenable to treatment. We have been taught largely by the labors of the younger *Gross* and *Halsted* that even cancer no longer necessarily entails death by recurrence, but that if we remove the growth early and thoroughly, we can obtain a cure, which in the hands of Mr. Cheyne* has recently reached the extraordinary result of 57 per cent. of *permanent cure* in cancer of the breast.

* Lancet, 1896, 1, p. 397.

Not only has the exterior of the chest been invaded, but the ribs and the sternum are now resected, and when necessary the entire chest wall, over a large area, is removed with impunity.

Few of us, excepting the older living members of the profession, can remember the immense advance which paracentesis of the chest made, by reason of the persistent and fruitful researches of *Bowditch* and *Wyman*, about 1850, out of which have grown Estlander's and Schede's heroic and successful operations. Not only have accumulations within the pleura been evacuated, but *Roberts* was among the pioneers in the operation of paracentesis pericardii, while the surgery of the lung is now taking its first tentative steps. The pericardium has also been sutured, and even the heart itself has twice been sutured, with one complete recovery.*

We were taught by the younger *Gross* that the great veins could be successfully tied, and recently they have been successfully sutured—even the lateral sinus. The recent researches of *Abbe*† and *Murphy*‡ may open a new chapter in the surgery of the arteries by substituting suture with preservation of their lumen for occlusion by the ligature.

Quite as fruitful has been the surgery of the digestive tract. Foreign bodies in the œsophagus, which were very inefficiently dealt with fifty years ago, thanks to the Roentgen rays and modern surgical methods are now, in the large majority of cases, successfully removed. In non-malignant stricture of the œsophagus *Abbe's* bowstring method has been a credit to American surgery.

I can do scarcely more than allude to the surgery of the stomach: to the value of gastro-enterostomy; to pylorectomy; to pyloroplasty; to dilated stomach, in which a tuck has been taken both by European and American surgeons; or

* Farina, Rev. de Chir., 1897, 335; Rehn, Lancet, 1897, 1, 1306.

† N. Y. Med. Rec., Jan. 13, 1894, 39.

‡ N. Y. Med. Rec., Jan. 16, 1897, 73.

hourglass contraction of the stomach, which *Weir* and *Watson* have successfully remedied by operative procedures; to gastrostomy in stricture of the œsophagus or *Richardson's* gastrotomy for the extraction of foreign bodies in the œsophagus. In the surgery of the entire intestinal tract, America, it can be safely said, has led the world. To no one laborer in this field is more credit due than to the distinguished President of the American Medical Association (*Senn*), to whose irrepressible labor, genius, and skill we owe most of our means and methods of dealing with such diseases. He first showed us the most successful methods of making intestinal anastomosis, from which have arisen all of our modern methods of treatment of cancer of the large and small intestines, and many allied conditions. From these fruitful labors also have arisen our modern methods of the treatment of intestinal and fecal fistulæ, even in some cases reaching so far as the total exclusion of a considerable portion of the bowel. The modern, wonderfully successful treatment of wounds, whether stab wounds, gunshot wounds, or others of the stomach, intestine, or bladder, owe their success largely to the labors of the elder *Gross*, *Parkes*, *Senn*, *Bull*, *Murphy*, and other Americans.

Cancer of the rectum, which, until about ten years ago, was almost inoperable, has now taken its place among the formal and justifiable operations of modern surgery, so that as much as twelve inches of the rectum have been resected by Kraske's method. The mortality has been reduced to 20 per cent., and permanent cure of such a formerly fatal disease has been attained in over one-third of the cases which recovered.*

The other accessory organs in the abdomen have been conquered by the modern surgeon. Fifty-seven tumors of the liver have been removed with a mortality as low as thirteen and one-half per cent.† The world owes to America

* Therap. Gaz., April and May, 1897.

† Trans. Pennsylvania State Med. Soc., 1897.

the operation of cholecystotomy, since it was first done by *Bobbs* in 1867, and was popularized by the powerful influence of *Sims* in 1870. Pancreatic cysts, chiefly through the labors of *Senn*, are now amenable to treatment, while the spleen has been extirpated many times.

The appendix, that meagre, but most troublesome, ancestral vestige, which, with the bicycle, has been the faithful friend of the surgeon through the past few years of commercial depression, has been recognized within the last few years as the real origin of the so frequent abscesses in the right iliac fossa. Beginning with *Willard Parker's* paper, in 1867,* and *Fitz's* memorable paper, in 1886,† the treatment of appendicitis, and even its much abused name, are distinctly of American origin, and an immense credit to American surgery.

Until Simon's classical experiments on dogs, in 1870,‡ the kidney was a practically inaccessible organ, but now, when it wanders, we secure it by sutures; when there is a stone in it, we open it fearlessly and remove the stone; when it is distended with pus or urine we drain it, and if it is past hope of recovery we extirpate it, all with most remarkable success. Even stones in a ureter or a divided ureter, *Cabot, Fenger, Kelly*, and *Van Hook* have shown us, can be successfully dealt with.

The treatment of stone in the bladder has undergone an extraordinary revolution since the introduction of *Bigelow's* litholapaxy. Its introduction as a surgical procedure was dependent on the prior researches of *Otis* and other Americans, who showed us that the calibre of the urethra was much greater than we had supposed, and permitted, therefore, the introduction of instruments of much larger diameter than before had been deemed allowable. The reintroduction of suprapubic cystotomy, due largely to *Dulles's* paper in 1875,§

* N. Y. Med. Rec., 1867, ii, 25. † Trans. Assoc. Amer. Phys., 1886.
‡ Deutsche Klinik, xxii, 137. § Am. Jour. Med. Sci., lxx, 39.

has permitted us to deal not only with large stones, but also with ulcers and tumors of the bladder; even large portions of the wall of the bladder have been removed successfully. The enlarged prostate is now, though always a serious danger, far less a menace to comfort and life since the introduction of McGill's and other methods of prostatectomy, and of *White's* operation of orchidectomy or the resection of the vas deferens.

The surgery of the pelvic organs has, one may say, been created since 1847, but its triumphs are so many that time allows only a word. *Sims's* treatment of vesico-vaginal fistula and his introduction of silver wire in 1852 were distinctly American triumphs, while the labors of the *Atlees*, *Kimball*, *Peasley*, *Goodell*, *Thomas*, *Emmet*, *Battey*, and *Kelly*—household names to all of us—have made pelvic surgery so successful that the danger is that it may be overdone. Many an ovary or womb, in the words of the witty toast, "absent from the body, but present in the spirit," would far better have been left in possession of their owners.

The radical cure of hernia has been the product of the last twenty years, and the operations of *Halsted*, Bassini, and Macewen, not to mention the many others, have taken a permanent place in the practice of the profession within the last ten years.* When we can report, as *Coley*† has recently done, 360 cases, with only 1 death and 7 recurrences, or, as De Garmo has reported at this very meeting, 250 cases unmarred by a single death, the question of the propriety of operating for the radical cure of hernia, even in children, is settled once for all.

Goitre fifty years ago was simply allowed to run its course, since hæmorrhage destroyed nearly all those operated on;

* Marcy informs me that he published his first paper on the use of the buried suture in 1870, and in 1881 he insisted on restoring the obliquity of the inguinal canal and using tendon sutures.

† Annals of Surg., March, 1897, 270.

but two years ago Kocher* reported a series of a thousand operations, with a mortality of but one per cent., in non-malignant cases.

Extirpation of the larynx for malignant growths has taken its place among the justifiable and formal operative procedures. Acute intestinal obstruction, whether from bands, volvulus, intussusception or other conditions, is now dealt with as it ought to be,—surgically,—and, if promptly done, with the happiest results.

A hasty and very imperfect review, such as has been above given, of the improvements in surgery within the last fifty years, does much more than show us the adroitness, audacity, and success of the modern surgeon. That is the thing which strikes us most as surgeons, but we must regard all this progress also from the standpoint of the patient and the community, and see what it means. It means a prolongation of life by operations which, while not without pain and suffering during recovery, have been robbed of all their primary terrors by anæsthesia, and most of their subsequent pain and suffering and danger by antisepsis; it means that patients who in 1847 were hopelessly consigned to the grave after weeks and months of suffering are now, in the vast majority of cases, rescued from death; it means that families formerly bereft of husband and wife, parent or child, and left to spend years of sorrow, of suffering, and—in many cases—of poverty, because the breadwinners were taken away, have now restored to them their loved ones in health and strength and usefulness; it means that the hecatombs of a Cæsar, an Alexander, a Napoleon, are offset by the beneficent labors of a Morton, a Warren, a Lister, who are, and for all time will be, blessed by many a poor patient, who never heard of them, instead of being cursed as the destroyers of nations and of homes innumerable; it means that man's inhumanity to man shall be replaced by a scientific and Christian altruism, which sheds

* Beilage z. Centralbl. f. Chir., 1895, 66.

blessings and benefits on the whole human race, seeing in the patient, whether saint or sinner, only a human being who is suffering from accident or disease, whom it is the province of the surgeon, in imitation of Him who went about doing good, to restore to health and happiness. Even where life cannot be prolonged, the agonies of death itself can be soothed by his gentle hand and his fruitful skill.

What the future has in store for us we can only dream. Two diametrically opposing tendencies are prominent in modern surgery: radical interference with disease so that there is now scarcely a single organ or portion of the body not within our reach; yet, on the other hand, a remarkably conservative tendency in cultivating remedial rather than radical surgery. Joints so diseased as once to require amputation are now treated conservatively with the best results; ovaries, a portion of which can be preserved, are kept in the abdomen; kidneys once doomed to total extirpation are now partially removed, and bones so destroyed that they formerly required amputation are now excised and the limb preserved. Experiments upon animals have recently given us wholly new views of infection and of the origin of many diseases, and also the little knowledge that we yet have as to either natural or acquired immunity, and to a consequent orrhotherapy.

It is, I believe, on these lines that our more immediate future triumphs will be achieved. We have discovered the actual cause of tetanus, tuberculosis, erysipelas, suppuration, and a host of other diseases and conditions, of the cause of which we were wholly ignorant a few years ago. The causes of many other disorders, both medical and surgical, still remain hidden from our view. We know almost nothing of the origin of benign tumors, and are groping to discover the origin of cancer, sarcoma, and other malignant growths. When we have discovered the cause, we are nearly half way, or at least a long way, on the road to the discovery of the cure, and I think it not unlikely that in 1947 your then orator will be able to point to the time when a definite knowledge of the causes of these diseases was attained, and probably to a time when their cure was first instituted.

That will be a surgical Paradise, when we can lay aside the knife, and by means of suitable toxines or antitoxines, drugs or other methods of treatment, control inflammation, arrest suppuration, stay the ravages of tuberculosis and syphilis, abort or disperse tumors, cure cancer, and, it may be, so prolong human life that all of his then audience will die either of accident or of old age. Would that you and I could be alive in 1947 to join in the glorious surgical *Te Deum!*

THE DEBT OF THE PUBLIC TO THE MEDICAL PROFESSION.*

IT is a graceful courtesy, which I very highly appreciate, that you should ask a stranger, instead of one of your own members, to address you on this festal occasion. The fact that you have completed an existence of a century as a medical society naturally suggests that the address should be somewhat of a review of the past.

I have, therefore, chosen as my subject "The Debt of the Public to the Medical Profession." I shall endeavor to indicate, in a brief outline, how much the profession has done for the community. The conclusion, therefore, is inevitable that there is an obligation on the part of the public to recognize this debt by affording enlarged facilities to a profession which has given of its time and labor so unselfishly for the good of the public.

In one respect the medical profession differs from all others, in that it is the only profession which is self-destructive. While we live by ministering to the wants of those who are suffering by accident and disease, I glory in the fact that the medical profession is foremost in the endeavor to abate disease and to prevent accident. The profession could not have attained this end by its own efforts alone, but it has been pendent very largely upon the general intelligent co-operation of the public, and of sanitary engineers, and also of legis-

* The Oration delivered before the Medical and Chirurgical Faculty of the State of Maryland, at the Celebration of the Centennial Anniversary of their Foundation, April 26, 1899. Reprinted from the Philadelphia Medical Journal, April 29, 1899.

lators, for the legal means to make effective the measures which the profession has shown to be needful for the public health.

Public hygiene or sanitation has been a very large element in arresting the ravages of disease, which, in former times, swept over entire nations, and even continents; and it is a source of pride to us that among the foremost sanitarians in every community are the doctors. It is a very striking fact that diseases which once assumed the form of veritable pestilences are now, at least in civilized countries, almost unheard of, and others, though they have not yet disappeared, have had their fangs drawn, so that the public suffers far less than it formerly did. If the voice of the profession were heeded, even the diseases which have been only abated would almost, if not entirely, disappear.

Let us briefly consider a few of these diseases:

I. The Plague.—Among the most fearful epidemics which have devastated the world, perhaps the worst has been what is known as the plague. It is represented now by the bubonic plague, of which we have had a memorable instance within the last two years in India, when over 250,000 lives have been lost. But, bad as it has been there, its recent devastation is as nothing compared with its former ravages. Those of you who have read James's novel, entitled "The Fire and the Plague," will recall the vivid and frightful picture of the plague in 1665, during which 70,000 persons perished in the then relatively small city of London alone. Still earlier, in the fourteenth century, the Black Death, as was then its horrible name, swept over Europe, and carried off 25,000,000 people, one-fourth of the entire population of that continent! This frightful destruction, it will be observed, took place in the then most civilized countries of the world. By contrast, the bubonic plague of the nineteenth century is limited wholly to peoples who are only semicivilized, among whom sanitary laws are not understood, and the grossest violation of them is a common everyday occurrence. But this terrible mortality, it would seem, is never to be repeated. As a result of laboratory researches the bacillus of the plague has been discovered, and Haffkine has recently introduced a preventive inoculation with sterilized bouillon-cultures of its bacillus. In India, which is now the home of the plague, Haffkine has shown extraordinarily good results, both in experimental inoculations of animals and of man. For example, of 20 rats from a ship, newly arrived from Europe, 10 were inoculated with the protective serum and 10 were not. Into the cage in which the whole 20 were kept, a rat suffering from the plague was introduced. Of the 10 uninoculated rats, 9 died. Of the 10 rats rendered immune by inoculation, only 1 contracted the disease. Following upon this and many other experiments, it was deemed right to inoculate human beings, and there are thousands now who owe their lives to this preventive inoculation.

To take but a single instance, in the town of Lower Daumaun, 2197 persons were inoculated, 6033 remaining unprotected. Of the latter 1482 died, almost twenty-five per cent., whereas only 36 of those who were inoculated succumbed to the disease, less than one and two-fifths per cent.*

Would it be an impertinent question were I to ask whether there could be mentioned a single lawyer who has thus cut off the means of livelihood of his brothers-in-law, or a single merchant who would so destroy his own business and that of his fellow-merchants by pointing out a means by which the community could dispense with his wares?

II. Cholera.—Another scourge which has been almost throttled in civilized countries is cholera. It first appeared in Europe in 1832, and in France alone 120,000 people died. In the single city of New York there were 3500 deaths. Its ravages have been conspicuous very recently in the

* Osler's Practice, 3d edition, p. 193.

city of Hamburg, when in three months, in the summer of 1892, there were 18,000 victims, with 7614 deaths. Engineers and physicians can proudly point to their achievements in this epidemic. The city of Altona, which is physically continuous with Hamburg, drank the water of the Elbe, but, being located nearer the mouth, drank the water with all the added contamination of Hamburg; yet in Altona there were only 516 cases as against 18,000 in Hamburg, and many of the 516 were refugees from Hamburg itself. The explanation is a very simple one. Hamburg drank the unfiltered water of the Elbe, whereas the inhabitants of Altona had a filtration plant, which was their efficient bulwark against the disease.

This is taking into account only the question of life, which is, of course, by far the most important. But looking at it also from a commercial point of view, we all remember how the business of Hamburg was for the time ruined. The few millions which would have properly filtered the water of the same river for Hamburg were lost five or ten times over by the merchants of Hamburg as a result of their fatal delay. The voice of the physicians and sanitarians of Hamburg was but a voice crying in the wilderness until emphasized by the hoarse diapason of disease. This is an object-lesson which our own country and many of our own cities would do well to heed.

III. Yellow Fever.—Another scourge, similar in its extent and its violence to the plague and to cholera, and one which appeals to the people of this country even more than those two, is the yellow fever. The fearful epidemic of 1797 is well known to every intelligent American. Not limited to the southern portion of our country, its pathway was strewn with corpses in all the larger cities of the North as well as of the South. Our own immortal Rush has left a monument to his name in his efforts to stem the tide of the disease. By his unselfish bravery and his devotion to duty in the midst of pestilence he has set us an example which the whole country admires, and which, fortunately, will never again be needed. The later freedom of this country from similar widespread and fatal epidemics of yellow fever is due chiefly to intelligent plans for sanitary reform and to our vigilant quarantine regulations, which, as a rule, during the present century have kept it at bay.

We are now about to do better, for having driven the indolent and ignorant Spaniard from Cuba, we shall be able to attack the disease at its fountain head. The efforts of our officers, especially of General Wood, whom we gladly recognize both as doctor, diplomat, and warrior, will bear the richest harvest of good by exterminating the disease in Cuba itself. Before this we could only erect a defensive wall against the disease; now we can prevent it in its very home.*

How much such prevention of disease means commercially is shown by a statement in the newspapers only ten days ago, that capitalists had $40,000,000 ready to invest in New Orleans if the sewage question could be solved and epidemics of small-pox and yellow fever prevented.

IV. Scurvy.—Prior to the present century, scurvy was one of the most dreaded diseases, especially on shipboard. Armies were decimated by it and navies rendered useless; sometimes half a ship's crew would be disabled by scurvy. Until the researches of physicians showed that it owed its origin to the lack of fresh vegetables, its ravages were fre-

* Through the efforts of the commission of which the late lamented Major Walter Reed was a member, the mosquito has been discovered to be the only means of propagating yellow fever. By preventing the access of the mosquito to yellow fever patients the disease has been banished from Cuba for the first time in one hundred and seventy years! This means also that it has been banished from the United States as well. Colonel William C. Gorgas Chief Sanitary Officer of the Panama Canal zone will do for that region the same splendid life-saving work he did in Havana.—(W. W. K., 1905.)

quent and widespread. In 1795 there were introduced into the British navy the admirable regulations for provisioning ships of war, drawn up by Blane. Since then scurvy has almost disappeared. At the present time it is seen only in exceptional circumstances, such as have recently arisen in the Klondike. Even in the long, lonely voyages to the pole, our means of furnishing the crews with vegetable food in various forms has prevented any outbreak of importance.

V. Typhus Fever.—Another scourge of humanity in past ages has been the dreaded typhus fever. Its various synonyms—ship-fever, hospital-fever, jail-fever, camp-fever—reek of filth, overcrowding, and the want of sanitation. "A complete history of typhus," says Murchison, "would be the history of Europe for the last three and a half centuries." It was as dreaded as the plague itself. How rare it is now is shown by the fact that in my entire professional life of nearly forty years I have never known in Philadelphia of more than half a score of cases, and have never in my life personally seen a single one. The modern exemption of armies, ships, jails, and hospitals from typhus is due to our own profession more than any other agency.

VI. Typhoid Fever.—I wish I could tell the same story of typhoid fever. Unfortunately the public has not yet listened to the voice of sanitary physicians. Every year a large harvest of deaths is furnished the grim reaper in almost all of our American cities by typhoid fever. And yet typhoid is as preventable a disease as typhus. The means of its diffusion are well known. Water contaminated by the typhoid bacilli and milk similarly contaminated are the two chief means by which it reaches the gastro-intestinal tract of man. What damage can be done by a single case was well shown in the town of Plymouth, Pennsylvania, in 1885. "A portion of the water of the town was derived from a reservoir supplied by a mountain stream some distance above. A man ill with enteric fever occupied a house near the bank of this stream, during January, February, and March. Upon the ground, frozen and covered with snow, the copious dejections of this patient were thrown without disinfection. Toward the end of March a thaw, accompanied by rain, took place. About the 10th of April an extraordinary epidemic of enteric fever developed in the town, chiefly among those receiving water from the reservoir. In a population of 8000 people, about 1200 cases occurred." The remedy, as some of us in Philadelphia have tried to point out as forcibly as we could, is clear. Purify the water-supply and provide good sewerage and typhoid fever almost disappears. In Vienna the typhoid rate of 12.5 deaths per 10,000 inhabitants fell to 1.1 after a pure water-supply was obtained; in Dantzig it fell from 10 per 10,000 to 1.5; in Munich, from 21 per 10,000 to 6.3; in Boston from 17.4 per 10,000 to 5.6. These are but cold figures. If we could transfigure them and let them represent broken hearts and desolated homes, and measure them by anguish and sorrow, they would speak more eloquently than mere percentages.

All of the diseases thus far considered have been those which have disappeared either wholly or very largely (at least in civilized countries) as a result of improved sanitation, and I can, therefore, well claim that the public owes their disappearance or limitation to the efforts of the medical profession aided by engineers, by intelligent legislators, by improved methods of food-supply, and by the general intelligence of the entire community. But the greatest preacher of righteousness has been the doctor.

VII. Small-pox.—The next disease to which I ask your attention is one which owes its abolition wholly to the physician. In these days, a century after Edward Jenner's memorable inoculation of James Phipps on May 14, 1796, we can hardly appreciate what small-pox was. A few facts, however, will show its dreadful ravages. Dinsdale, who went to St.

Petersburg to inoculate the Empress Catharine, says that 2,000,000 people died in a single year in the Russian Empire from small-pox. In 1707, in Iceland, out of a population of 50,000, 18,000 died,—thirty-six per cent.! In Mexico in the sixteenth century, 3,500,000 people died, leaving, in some places, scarcely enough alive to bury the dead. At the end of the eighteenth century, Gilbert Blane estimated that "an adult person who had not had small-pox was scarcely met with or heard of in the United Kingdom." When servants were advertised for, it was common to specify "that they must have had small-pox in the natural way." In 1688, in an advertisement for a counterfeiter, it was noted as a means of his identification that he was "*without* pock-holes." At the Institution for the Indigent Blind, two-thirds of the applicants were made blind by the small-pox.

It attacked the high as well as the humble. In the family of William III of England, his Queen, Mary, his father, his mother, his uncle and two cousins, children of James I, all died of the small-pox and the king himself barely escaped with his life. During the eighteenth century, one Emperor and two Empresses of Austria, six archdukes and archduchesses, an elector of Saxony, an elector of Bohemia, a Dauphin and a King of France, a King of Sweden, and a Tsar of Russia were all numbered among its victims. So fearful were its ravages that Bernouilli estimated that 60,000,000 persons died from small-pox in the century the close of which saw the foundation of your own Faculty. Well might Macaulay say: "The havoc of the plague had been far more rapid, but the plague visited our shores only once or twice within living memory. But the small-pox was always present, filling the churchyard with corpses, leaving on those whose lives it spares the hideous traces of its power, turning the babe into a changling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to her lover." It was "the most terrible of all the ministers of death."

But in 1796 arose the medical David who was to smite this Goliath. From that time till the present small-pox has been shorn of all its terrors. Very recently, in Jenner's own country, attempts have been made to show that vaccination was useless; that it drove out of the system one vile disorder by introducing another, that it disseminated instead of preventing disease. Were we to grant all that is falsely alleged as to the introduction of tuberculosis and syphilis, even then the benefits it has conferred would outnumber the evils ten-thousand-fold. But, as a matter of fact, the cases in which evil results have followed are few and far between, and by the use of animal virus instead of the humanized and by the proper antiseptic care in vaccination (which is really a minor surgical operation) all of these ill effects can be avoided.

A few statistics will show the benefits vaccination has conferred. In Sweden, before vaccination, the deaths per million were 2045. Since compulsory vaccination was introduced they have fallen to 155. In England during the eighteenth century, the average deaths per million were about 2000. Since the epidemic of 1871–72 and the enforcement of the law for vaccination, the deaths have fallen to 53 per million, and in Scotland they have fallen to 8 per million. In Prussia, before compulsory vaccination, there were 309 deaths per million; in the last ten years only 7. In Austria, without compulsory vaccination, in the last ten years the average has been 458 deaths per million, and in Belgium without compulsory vaccination from 1875 to 1884, there were 441 deaths per million. In the Sheffield epidemic of 1887–88 of the unvaccinated population, 1 in 20 died; of those who were vaccinated, 1 in 1300.

Another illustration of what havoc a single mild case may work was seen by the epidemic in Montreal fourteen years ago. Among the French Canadians, there was the greatest prejudice against vaccination, so much so that there were even vaccination riots. As a consequence of this prejudice a large unprotected population grew up and the materials were ready for an extensive epidemic. The soil had been prepared and it only needed the introduction of the seed, which in due time came in a Pullman car conductor from Chicago, February 28, 1885. Within the next ten months thousands of persons were stricken with the disease and 3164 died in a city of only 185,000 inhabitants—*i. e.*, one person in every 58 died, besides all those whose lives were blighted by its disgusting relics. Perhaps no more striking proof could be given of the value of compulsory vaccination and revaccination than the experience of Germany and France in the Franco-Prussian war. In the German army there were but 261 cases, while in the French army, which was not similarly protected, there were 23,469. Again, our Philadelphia Welch* has shown that among 5000 cases of small-pox, of 1412 cases with good vaccination marks, the death rate was 8.78 per cent.; whereas among 1759 cases unvaccinated, the death-rate was 58.38 per cent.

And yet in the face of these well-established facts there are people who declaim against vaccination. Happily, in view of the well-known and almost universally recognized protective power of vaccination, the good sense of the American people will never allow us to go back to the old days of death and disfigurement. Well may Professor Whittaker say "the most consummate cynic must admit that, up to the present time, Edward Jenner has been the greatest benefactor that the world has ever known." Even the untutored Indians declared "we shall not fail to teach our children to speak the name of Jenner and to thank the Great Spirit for bestowing upon him so much wisdom and benevolence."

VIII. Tuberculosis.—The most noteworthy feature in modern medicine is the introduction of laboratory methods in the study of various diseases. We are only really at the beginning of this method, but it has yielded results of

* New York Med. Jour., March 17, 1894.

such inestimable value that its future is certain to reward the diligent searcher after truth with a rich harvest.

Among other diseases which have been investigated with very fruitful results is tuberculosis, a disease which ranks with alcoholism and syphilis as the three most disastrous to the human race, and, in the case of tuberculosis, to animals as well as man. To Robert Koch, of Berlin, a physician, belongs the credit of discovering and of proving absolutely its cause, namely, the bacillus tuberculosis. While it is perfectly true that this has not yet led to the hoped-for results in the cure of the disease, yet all must admit that the discovery of the cause of any disorder is the first step toward its cure. Moreover, the results, even from a diagnostic and therapeutic standpoint, have been by no means insignificant.

First of all it has enabled us to determine positively the existence of tuberculosis of the lungs and the intestines with absolute certainty, and at a much earlier stage than was before possible. Hence even the ordinary treatment at our disposal, change of climate and the administration of remedies, is instituted at a much earlier period than formerly, and so leads to cure in cases which, under the older, uncertain methods, would have run on until they had become practically incurable. Secondly, although the tuberculin treatment of Koch has not realized all that was hoped for, yet by better methods and improved tuberculin, a number of cures have resulted. Even had Koch's researches proved of no value to the human race, its value in the early and certain diagnosis of the disease in the lower animals has been of the greatest possible service to our dairymen and butchers in the preservation of their herds, and to the community in preventing the use of tuberculous meat and milk as articles of food, a use which is fraught with the greatest danger to human beings. The reaction which follows the use of tuberculin in animals is acknowledged by all veterinary surgeons as practically of the greatest use in weeding out tuberculous animals from herds of cattle. It is not too much to hope that further researches may yield a healing serum which will show far better results than anything thus far produced. Even the present results have justified all the labor and expense which have been involved in the discovery of the cause of tuberculosis.

IX. Diphtheria.—The laboratory has given us a proof of its value, however, in another direction, in which we are treading on much firmer ground. Diphtheria is one of those diseases which does *not* yield to improved sanitation. Whether it show itself in sporadic cases, or as an endemic or epidemic, its death-rate has been appalling. Until a few years ago its mortality was placed at about forty per cent. of all the cases attacked. But laboratory researches and experiments upon animals have robbed it of more than half its terrors. Perhaps the three most important papers thus far published are those of your own Prof. William H. Welch* and the collective investigations of the American Pædiatric Society of 1896 and 1897. Welch investigated 7166 cases from eighty different sources. Among this large number of cases, 1239, or only 17.3 per cent. died, a diminution in the mortality, as a result of the use of the antitoxine of 55.8 per cent. It is very striking also, to observe the different results of the treatment according to the day on which it was begun. The following table shows the regularly increasing mortality according to the day on which the treatment was begun, from the first to the eighth days:

Day.	Mortality Percentage.
1	18.3
2	22.7
3	38.1
4	53.6
5	67.0
6	67.4
7	72.5
8	81.6

* Johns Hopkins Bulletin for 1895.

Could figures be more eloquent, or call more loudly for the earliest possible use of the remedy?

In the first collective report of the American Pædiatric Society there were nearly 6000 cases in the practice of 615 physicians. The large number of physicians from all over this country and Canada eliminates accidental variations due to climate, to the personal equation of any one physician, etc. The mortality was 12.3 per cent. or, deducting the 218 cases which were moribund at the time when the treatment was begun, a mortality of only 8.8 per cent. instead of 40 per cent.! In over 4000 cases, in which the treatment was begun during the first three days, the mortality was only 4.8 per cent. The results of this treatment are still more striking in the laryngeal cases, which require intubation or tracheotomy. In 5546 such cases reported by 242 physicians before the introduction of the serum, the mortality was 69.5 per cent. In 533 cases in which the serum was used the mortality was but 25.9 per cent. In the report of 1897 it is stated that before the introduction of the serum treatment, 90 per cent. of the cases of laryngeal diphtheria required operation; after its introduction, only 39.2 per cent. Before the serum treatment was introduced, recovery took place in 27 per cent. and death in 73 per cent.; after the serum treatment was introduced the figures were precisely reversed; recovery took place in 73 per cent. and death in 27 per cent.

In the "Philadelphia Medical Journal" for April 1, 1899, p. 631, is given the still more recent results in Chicago. In ten years of the pre-antitoxine period the annual average of deaths was 1417. In the three years after the antitoxine treatment was introduced, though the city's population was larger both by natural increase and by annexation, the annual average was only 851 deaths, a direct saving of 600 lives a year, and a forty per cent. reduction of the previous mortality. The closing remarks of Professor Welch are eminently in point: "The discovery of the healing serum is entirely the result of laboratory work. It is an outcome of the studies of immunity. In no sense was the discovery an accidental one. Every step leading to it can be traced, and every step was taken with a definite purpose and to solve a definite problem. These studies and the resulting discoveries mark an epoch in the history of medicine. It should be forcibly brought home to those whose philozoic sentiments outweigh sentiments of true philanthropy that these discoveries which have led to the saving of untold thousands of human lives have been gained by the sacrifice of the lives of thousands of animals, and by no possibility could have been made without experimentation upon animals." Each year, for all future time will add other thousands of human lives thus saved by the laboratory.

X. *Hydrophobia.*—Another direct result of laboratory research is the splendid achievement of Pasteur in the cure of hydrophobia. Prior to his researches about 14 per cent. of those bitten by animals believed to be rabid were attacked by hydrophobia, and of the persons so attacked everyone died—a mortality of 100 per cent. There is no authentic case reported of recovery after the development of hydrophobia. But in 1893 the mortality in St. Petersburg, in cases submitted to Pasteur's treatment, was only 0.84 per cent.; in Turin (report for 1894) the mortality for the preceding ten years was only 0.95 per cent.; and in Paris, in 1897, in 1060 persons bitten by animals, proved experimentally or diagnosticated by a veterinary surgeon to have been rabid, the mortality was only 0.56 per cent. Instead of 141 deaths from a horrible and formerly irremediable disease there were only 6 deaths!

Figures such as these can leave no doubt in the minds of reasonable persons that this gift of the laboratory has been of the greatest possible value.

XI. *Trichinosis.*—Another direct result of laboratory research has been the discovery of the trichina worm. When studying in Berlin in the winter of 1865-66 I well remember the demonstration, among the first that had then been made, of the cause of a dreadful epidemic of trichinosis. In the little town of Hedersleben, in Saxony, a butcher killed three hogs and made them into sausages. They were eaten by a large number of the inhabitants of the little town. Several hundred persons fell desperately ill and I think over one hundred died. Professor Virchow sent one of his assistants to the town to discover the cause of the trouble, and all of the students in the Pathological Institute in Berlin were intensely interested in the discovery that the epidemic was due to the fact that one of these hogs had been infected with the trichina. A portion of the infected pork was brought to Berlin and fed to some of the lower animals and the life history of the trichina was studied with the minutest care. As a result of this and of similar studies, the method of preventing the disease was very soon discovered. Heat kills the worm and so renders it innocuous. The epidemic in Hedersleben was due to the fact that the inhabitants had eaten insufficiently cooked sausages in which the parasites were still alive. Digestion dissolved the capsule in which they lay and freed them for their future devastating work. Cooking would have entirely prevented the epidemic. Since these studies, all civilized countries have made obligatory by law the microscopical investigation of several portions of the carcasses of all hogs which have been killed for food, and all of our meats derived from the hog now are perfectly innocuous by the elimination of all the infected carcasses.

XII. Animal Diseases.—Had I the time and were I as familiar with the facts in veterinary medicine as in human medicine, I should be able to point out to you the laboratory studies which have been undertaken abroad and in this country by our admirable Bureau of Animal Industry as to anthrax (wool-sorters' disease), the cattle plague, chicken cholera, swine fever, hog cholera, and lumpy jaw or actinomycosis, and show you that not only is the human race a debtor to the laboratory, but how much animals themselves owe to it. The commercial value of these researches in a country like ours, which exports immense quantities of meat, can hardly be overestimated. It is within the mark when I say that many millions of dollars are saved annually in our flocks and herds as a direct result of such laboratory investigations. Inasmuch, also, as a number of these diseases are capable of infecting the human subject (and the number of cases of anthrax and of actinomycosis is large), they are as important to the human race as to animals.

Let us now leave medicine proper and turn to surgery. Before doing so I must point out the fact that all the diseases so far considered are medical, and not surgical. I often hear it said that, while surgery has made such giant strides of late, medicine has lagged behind. It is but just to the physicians to call attention to the fact that the statements already made show that medicine has made equal or even greater progress. The saving of life in diphtheria is less dramatic, less striking to the average mind, but it is none the less real or less beneficent.

XIII. Anæsthesia.—We come now to two of the epoch-making discoveries in the history of medicine, both of which have been made in the last half-century—the discovery of anæsthesia and of antisepsis. Though Long, of Georgia, had used ether prior to 1846, practically the introduction of anæsthesia dates from October 16, 1846, when, for the first time since Adam parted with his precious rib, Dr. John C. Warren, in the Massachusetts General Hospital, performed a major surgical operation without inflicting the slightest pain. The news went like wild-fire, and anæsthesia was soon introduced into every clinic and at almost every operation throughout the civilized world. Prior to that time a surgical operation was attended with horrors which those who live in these days cannot appreciate. He was the best surgeon who could perform any operation in the least possible time. The whole object of new methods of operating was to shorten the period of frightful agony which every patient had to endure. Every second of suffering saved was an incalculable boon. To submit to any operation required then a heroism and endurance which are almost incomprehensible to us now. All of the more modern, deliberate, careful, painstaking operations involving minute dissection, amid nerves and blood-vessels, when life or death depends on the accuracy of almost every touch of the knife, were absolutely impossible. It was beyond human endurance to submit one's self for an hour, for an hour and a half, for even two hours or longer, to such physical agony and in absolute physical repose.

It is a striking commentary on the immediate results of anæsthesia to learn that, in the five years before the introduction of ether, only 184 persons were willing to submit themselves to such a dreadful ordeal in the Massachusetts General Hospital—an average of 37 operations per annum, or 3 per month. In the five years immediately succeeding its introduction, although the old horror could not at once be overcome, 487 operations, or almost 100 annually, were performed in the same hospital. During the last year in the same hospital, a Mecca for every surgeon the world over, over 3700 operations were performed. It is not an uncommon thing at the present day for any one of the more active surgeons of this country to do as many as 400 to 500 operations in a year. I have known as many as 19 operations to be done in the Jefferson College Hospital in a single day—equalling six months' work in the Boston hospital before the introduction of ether.

Such a boon, the direct gift of the profession to a suffering world, has placed the public under a debt which can never be sufficiently appreciated, still less be repaid. Every sufferer may well bless the names of Morton and Warren, to which should be added certainly the name of that giant of surgery, Sir James Y. Simpson, who discovered the anæsthetic use of chloroform in 1847.

Both anæsthetics have their dangers, and the profession will never be satisfied so long as there is the slightest danger in the use of any such drug. Our researches are still directed toward the discovery of the ideal anæsthetic. This will not be, in my opinion, an anæsthetic like cocaïne, which abolishes pain without abolishing consciousness, but, rather, one which, without danger to life, will produce unconsciousness to everything, including pain, for this reason: Very frequently during an operation emergencies occur (especially hæmorrhage) which, although the surgeon is perfectly capable of coping with them, would greatly alarm the patient and might defeat the object of the surgeon, were they known to the patient at the time. That such an ideal anæsthetic will be discovered is as certain as that the twentieth century will soon dawn upon us. Happy will be the surgeons who can operate without the least fear of their anæsthetic, and yet be certain that the patient is relieved from all suffering and free from all danger of shock or other after-consequences.

XIV. Antisepsis.—Even the introduction of anæsthesia, however, did not rid surgery of all its terrors. The acute pain of the operation was abolished, but the after-suffering, as I knew only too well in my early surgical days, was something dreadful to see. The parched lips of the poor sufferer, tossing uneasily during sleepless nights, wounds reeking with pus, and patients dying by scores from blood-poisoning, from erysipelas, from tetanus, from gangrene, were only too familiar sights in the pre-antiseptic days. Then, again, there arose one of these deliverers of the human race whose name can never be forgotten and whose fame will last so long as time shall endure. Jenner, Warren, and Lister are a triumvirate of names of which any profession may well be proud. Thank God, they all sprang from virile Anglo-Saxon loins! No praise, no reward, no fame is too great for them. That Lord Lister still lives to see the triumph of his marvellous services to humanity is a joy to all of us. And when the profession arose *en masse*, within the last few years, at the International Congress of Berlin and at the meeting of the British Medical Association in Montreal, and welcomed him with cheer after cheer, it was but a feeble expression of gratitude for benefits which no words can express.

Before Lister's day, erysipelas, tetanus, gangrene, and blood-poisoning in its various phases were the constant attendant of every surgeon. They were dreaded guests at almost any operation; and when in rare cases we obtained primary union without a drop of pus, without fever, and with but little suffering, it was a marvellous achievement. Now it is precisely reversed. The surgeon who does *not* get primary union without a drop of pus, with no fever, and with little suffering, asks himself—What was the fault in my technic? To open the head, the abdomen, or the chest thirty years ago was almost equivalent to signing the death-warrant of a patient. The early mortality of ovariotomy was about 60 per cent.; 2 out of 3 died. Now many a surgeon can point to a series of 100 abdominal operations with a fatality of only 2 per cent. or 3 per cent.

This, too, is a direct result of laborious laboratory researches beginning with the investigations of Liebig and Pasteur on fermentation. Lister went still further. Even before the discovery of the bacteria of suppuration, of tetanus, and of erysipelas, he showed us experimentally how, by surgical cleanliness, we could avoid all infection and so banish these pests from our hospitals and bring life and health to many who otherwise would have perished from operations which are now perfectly safe.

The mortality of compound fractures in the pre-antiseptic days was about 60 per cent. It was one of the most dreaded of all accidents. Its mortality now is perhaps not over 3 per cent., and the mortality from sepsis after such a fracture, in the hands of well-instructed surgeons, is almost *nil.* Prior to Lister's day, the mortality of major amputations varied from 50 to 63 per cent. Now, it is from 10 to 20 per cent. And so I might go on with operation after operation and show how they have become so safe that one need not dread any, saving exceptional, cases.

These two modern discoveries, anæsthesia and antisepsis, have utterly revolutionized modern surgery. They have made possible operations which, by reason of their length and pain and danger, were utterly unjustifiable in former days, but are now the daily occupation of a busy surgeon. And, far better than this, they have enabled us to bring to homes and hearts, which otherwise would have been broken up and wrung with sorrow, the comfort of life restored to dear ones upon whom depended the happiness and support of the families. Translate figures into happy hearts and prosperous homes if you can, and then you can tell me what Warren and Lister have done for humanity!

XV. Bravery of the Profession.—But it is not only by its achievement in specific diseases that the profession has brought the community into its debt. Quite as much by his character has the physician pointed the way to the noblest development that human nature can attain. Not only has he diminished the horrors of war, but he has shared in its perils and has shown a disregard of danger and a fearlessness in the performance of his duty which is worthy of all praise. During the Civil War 40 Northern medical officers lost their lives in battle and 73 were wounded, a number "proportionately larger than that of any other staff corps." The heroism of Gibbs, who perished in Cuba, is known to you all. In the navy, Dr. John F. Bransford had resigned his commission as surgeon in 1890, but immediately volunteered for service in the war with Spain. During the battle of July 3, off Santiago, he dropped his scalpel and bravely took charge of a gun, fighting gallantly throughout the engagement, his services as surgeon not being called upon until the wounded prisoners were brought on board. Like the mother of the Gracchi, we may proudly point to such and say, "these are our jewels."

But while gallantry in action justly merits our highest admiration, there is a quiet, unostentatious bravery in the midst of pestilence which is no less heroic, though less dramatic.

"In 1832, that most dreaded of all scourges, Asiatic cholera, for the first time broke out all over this country with the greatest virulence. Easton was only eighty miles from New York, and the citizens, in terror lest the dread disease would reach their own town, appointed a young, intrepid surgeon to visit New York and learn what he could for their benefit. When others were fleeing in frightened thousands from the pestilence, Gross bravely went directly into the very midst of it, reaching New York when the epidemic was at its very height. In that then small and half-depopulated town 385 persons died on the very day of his arrival —and he stayed there a week in a hot July, visiting only its hospitals and its charnel-houses. What call you that but the highest type of bravery? —a bravery which Norfolk and Mobile and Memphis have since seen repeated by scores of courageous physicians ready to sacrifice their lives for their fellow-men, with no blare of trumpets, no roar of cannon, no cheer of troops, no plaudits of the press! No battlefield ever saw greater heroes; no country braver men!" (Page 241.)

And Gross was not alone in this bravery. Amid Arctic snows and surrounded with desolation, Kane and Hayes have shown what steady courage could do in Arctic exploration; while the revered Livingstone, in the midst of the wilds of Africa, surrounded by savage beasts and still more savage men, exposed to the dangers of fever and miasm on every hand, showed what the doctor could do amid torrid heats in the performance of his duty in exploring an unknown continent and in exterminating the traffic in human life. At this moment in India, Burma, China, Africa, two hundred and sixty-eight brave medical missionaries, of whom sixty-four are no less brave women, are endeavoring to bring the blessings of modern medicine and of Christianity to the natives benighted lands. "We can imagine," says the "Lancet," "no career more lofty or honorable than that of a well-informed, capable, and courageous medical missionary." Their efforts especially in bringing health to the down-trodden women of heathen lands, in their efforts to abolish child-marriage with all of its attendant horrors, and in their ministrations to the sick of body and of soul have been fruitful of the highest good to millions of the human race.

XVI. Generosity of the Profession.—Moreover, there is no profession which gives so freely for the good of the human race. Where is the doctor whose ear is deaf to the cry of suffering humanity in cases of accident, or during the pangs of maternity, who will not deprive himself of well-earned sleep and needed recreation, to minister to his suffering fellow-creatures without ever a thought of any pecuniary benefit to himself?

I am sure that the public does not appreciate the amount of time and the value of the services given to the poor by the rank and file of the profession. Take a single example with which I am familiar. In the Jefferson Medical College Hospital the last report shows 129 medical men on the staff of the hospital. As nearly as I can estimate, they give every year about 60,000 hours of their time to the poor, which, at 8 hours per diem, amounts to 20 years of labor of one man year after year; and their services, were they paid for at a very moderate rate, make an annual gift to the poor of over $500,000. This, mark you, is from a single hospital in a single city. Were we to take account of all the hospitals in every city and town in this country, you can easily see how many millions of dollars' worth of gratuitous services and how many decades of time are given to humanity every year by the medical profession. It is only by such vast aggregates that we can appreciate how much there is of generous giving on the part of the profession which we do well to love and honor.

How shall the public pay this great debt? "Freely ye have received, freely give." We do not ask dollar for dollar, but may we not expect a Scriptural tenth? Not for our own pockets, but for our hospitals; not to minister to our own ease and enjoyment, but to equip our libraries and laboratories for larger and more fruitful work; not for our own homes, but for our colleges to furnish us the means for better teaching; in a word, not for ourselves, but for humanity, to whose service our lives are dedicated.

In Mr. John Wanamaker's gallery is one of the most striking pictures I have ever seen. On a large canvas by Fritel, in the center of the picture, advancing directly toward the spectator, is a large cavalcade of warriors arrayed in corselet and casque. Their stately march at once arrests the eye. The leader is Julius Cæsar. He is flanked by Napoleon and Alexander the Great and followed by Attila, Semiramis, and a lengthening host of those whom the world counts among its greatest "Conquerors." They advance between two long rows of rigid, ghastly corpses all stretched at right angles to their line of march. Spectral mountains in the distance hedge in a desolate plain given over to the vulture, the bat, and silence.

I would that some artist might paint a companion picture of the "conquerors in medicine," instead of the "conquerors in war." Instead of spectral hills and a barren waste, the scene should be laid in a happy, smiling valley, bounded by the Delectable Mountains and kissed by a fertile sun. The stately procession should be led by Edward Jenner. He should be flanked by Joseph Lister and John C. Warren, and followed by Simpson, Billroth, Livingstone, Ambroise Paré, Virchow, John Hunter, and many a modest, but unknown hero who has yielded up his spirit in the performance of his duty. Instead of treading their way between lines of corpses, they should march between lines of grateful men and women and a host of God's little children who, on bended knee and with clasped hands, would reverently invoke Heaven's richest benediction upon their deliverers.

Thus should humanity recognize its debt to the medical profession.

THE ENDOWMENT OF MEDICAL COLLEGES.*

TWO duties seem to me to devolve on the President of the American Medical Association in his annual address. First, to consider the condition of the Association with any suggestions that may be made for improvement, and, secondly to take up some subject of professional interest which may be properly considered before the chief representative medical body of the United States.

[I omit those paragraphs dealing with the affairs of the Association.]

Turning, now, from the affairs of the Association, I wish to say a few words in reference to a subject of paramount importance which I am sure will appeal to the sympathies of all present, namely,—the need for endowments for medical schools.

The tide of charity in the United States has reached a remarkable height. The Chicago "Tribune" publishes an annual list showing that in 1894 the charitable gifts and bequests in the United States amounted in round numbers to $20,000,000; in 1895, to $29,000,000; in 1896, to $34,000,000; in 1897, to $34,000,000; in 1898, to $24,000,000; and in 1899, to the enormous sum of nearly $80,000,000.

But a small portion of this charity, however, has been bestowed upon medical schools. It is mostly to colleges, theological schools, hospitals, museums, and libraries that the principal amounts have been given. The cause for this, I

* Presidential Address, Fifty-first Annual Meeting, American Medical Association, Atlantic City, June 5–8, 1900. Reprinted from the Journal of the American Medical Association June 9, 1900

think, has been chiefly the vicious method in which all our practically joint-stock companies organized Medical Schools for the benefit of the faculties. As Professor Bowditch has said, one might as well expect the public to endow a cotton-mill as to endow such a school. The day of these private enterprises is now, happily, nearly past. The respectable schools of medicine are now conducted by trustees, a body of men wholly apart from the faculties, who manage the affairs of the medical school just as they would those of a university, taking control of the income and expenditures of the school, placing the professors and other teachers upon salaries and conducting the affairs of the institution on broad lines of educational progress. Partly as a result of this change, chiefly through the medical faculties, and largely, I am glad to say, as a result of the influence of the profession exerted through this Association, the courses of study at the medical schools of to-day, and, therefore, the necessities of the student, are so wholly different from those of twenty-five years ago that it may be well termed a new era in medical education. As a consequence of the broadening and lengthening of the medical course of study, the cost of medical education has enormously increased. The public at large do not at all appreciate this changed condition, and even you, members of the profession itself who may have graduated many years since, scarcely appreciate to its full value the difference. As a consequence, the fees of the students, which can scarcely be raised beyond the present amount, are wholly inadequate for providing a proper medical education, and the medical school appeals, as does the college, the theological school, and the technical school, for wise and liberal endowments in order to provide this suitable education. "There is no branch of education," says President Eliot, of Harvard, "which more needs endowment. Medical education is very expensive, because it has become, in the main, individual instruction. Large lectures and crowded clinics are seen to be of really very limited application, so that year by year the medical teaching becomes more and more costly."

What were the necessities of a medical school twenty-five years ago? Two lecture-rooms, in which seven professors talked, a dissecting-room, and, if possible, a clinic, which was occasionally, but rarely, in a college hospital. Practically the instruction which the student obtained, with the exception of dissecting, was limited to "book-knowledge" and "ear-knowledge." The student was not brought into actual personal contact with any patients or any concrete facts, observations, or experiments. He only listened to what his teachers said about them. Millions were given to hospitals, in which the sick were treated, but only sixpences to medical schools in which the men who are to care for their future patients were trained. "Spain," says Lyman Abbott, "in the late war had nineteenth-century guns and sixteenth-century men behind them. We know what came." Our splendidly equipped hospitals are the nineteenth century guns. Insufficiently trained doctors are the sixteenth-century men. The time has eminently come when the "men behind the guns" must equal in efficiency the weapons with which they do the fighting.

To perform a tracheotomy and rescue a child suffering from diphtheria is a dramatic occurrence which appeals to every one. To conduct a long series of experiments in the laboratory by means of which the cause of diphtheria shall be found and the necessity for a tracheotomy avoided, appeals only to the educated few; yet the service done by the operation is a service only to the one patient who may be rescued by the knife, while the other is a service to hundreds and thousands of patients for all time who will escape both the knife and the disease. Yet, such a series of experiments in preventive medicine brings no reward in money, a limited reward in fame, and only its largest reward in the consciousness of giving a great boon to humanity, for which it never can pay.

The era of the man who simply listened to what his teachers had to tell him and then went on his way, as a "rule of thumb" man is, happily, past. This is the era of the trained man and the trained woman, and training means opportunity provided by the community and time, labor, and money given by the man and the woman.

Let us look for a moment at what a medical school now needs. It stands for two things: First, "thing-knowledge," instead of "book-knowledge" and "ear-knowledge," teaching the facts of modern science, by scientific methods; that is to say, methods of precision. But, secondly, no medical school should be content simply with imparting the knowledge that exists. It should push back the boundaries of ignorance and by research add to existing knowledge.

In the accomplishment of the first duty of the medical school there are required, first, didactic lectures. I am not one of those who believe that the day of the didactic lecture is past. "Never," said President Faunce, of Brown University, in his notable inaugural, "never shall we be able to do without the personality of the teacher flaming with enthusiasm for knowledge, pressing up the heights himself and helping the student on."

In the 156 medical schools in this country there are, perhaps, over 1500 members in their Faculties. In all of them are inspiring teachers flaming with enthusiasm, for a not inconsiderable proportion may properly be so described, and the influence of such enthusiastic teachers is felt by the entire class. One or two such men in every school make a good Faculty. Besides the didactic lectures, a good working library and a reading or study room is a requisite. And it is a matter of no little encouragement that in the reports of the Commissioner of Education for 1898, 72 medical schools reported 151,433 volumes in their libraries.

Secondly.—The great difference between the modern method of teaching medicine and the older method consists in *laboratory instruction* and *clinical instruction,* both of which must be *individual.* Laboratories are very costly. They require buildings, equipment, and assistants. The number of laboratories required in the present day in a fully equipped medical school is astonishing. First, the dissecting-room—the anatomical laboratory, and along with this a laboratory of histology, and another which may be combined with it, a laboratory of embryology. Next, a physiological laboratory, in which each student will not become an accomplished physiologist, but will become familiar with physiological methods and be trained in exact and careful observation; a laboratory of chemistry and, combined with it, especially, a laboratory of physiological chemistry; in the department of materia medica, a laboratory of pharmacy, in which the student will not become a good pharmacist, but will learn the essentials of pharmacy so that he will not make, at least, gross mistakes, which otherwise would constantly occur. Still more important is a laboratory of pharmacology, in which he will learn the action of drugs and be prepared rightly to use them. In obstetrics, a laboratory of practical obstetrics and obstetrical operations is essential. In surgery, he needs a laboratory in which he shall be taught all the ordinary surgical operations. In pathology, he needs a laboratory of morbid anatomy, a laboratory of bacteriology, and a laboratory of hygiene. The mere statement of this catalogue of thirteen laboratories will enforce the fact that an enormous expense not only for the installation, but also for the running expenses, will be required. To show what one university abroad does, Professor Welch has stated* that the Prussian Government expends outside of the salaries of professors in the University of Berlin alone over $50,000 annually! What American medical school can show anything approaching an endowment which will provide such a sum?

* Higher Medical Education and the Need for its Endowment, Medical News, July 21, 1894.

And what has not the laboratory done for us within the last few years? It has discovered the cause of tuberculosis, tetanus, suppuration, cholera, diphtheria, bubonic plague, typhoid fever, erysipelas, pneumonia, glanders, and a host of other diseases; it has shown us how to avoid all danger from trichina so that our entire commerce in hog-products is conditioned upon the laboratory; it has shown us how to banish suppuration, erysipelas, tetanus, and pyæmia from our hospitals and reduce our death-rates after operations from 50 per cent. or 33 per cent. to 10, 5, 1, and often even fractions of 1 per cent.; it has given us a really scientific hygiene in which we no longer guess, but know; it has shown us the rôle of the mosquito in malaria, of the rat in bubonic plague, of the fly in typhoid fever; it has given us the power to say to diphtheria "thus far shalt thou go and no farther"; it will give us the power to utter a pæan of victory over typhoid, cholera, bubonic plague, tuberculosis, yellow fever, cancer, and other such implacable enemies of the human race—and yet there are those who would stay this God-given hand of help!

And the laboratory has had not only its devotees, but its heroes. Listen to the story of but one. Dr. Franz Müller, of Vienna, was one of those who in his investigations of the bubonic plague in 1897 contracted the dreaded disease from the bacilli in his culture-tubes. When he became certain that he was infected he immediately locked himself in an isolated room and posted a message on the inside of the window pane, reading thus:

"I am suffering from plague. Please do not send a doctor to me, as, in any event, my end will come in four or five days."

A number of his associates were anxious to attend him, but he refused to admit them and died alone, within the time he predicted. He wrote a farewell letter to his parents, placed it against the window, so it could be copied from the outside, and then burned the original with his own hands, fearful lest it might be preserved and carry the mysterious germ. Can you find me a finer example of self-sacrificing altruism? Was ever a Victoria Cross more bravely won?

But the establishment of laboratories with their attendant expenses is not the only improvement in our medical curriculum. Every well-conducted medical school requires a large hospital in connection with it. Here must be installed again a fourteenth laboratory of clinical medicine in which all the excretions of the body will be examined, tumors studied, cultures and blood-counts made, or else the patients in the hospital, from the modern point of view, are neglected. It is not too much to say that a patient requiring such examinations, be he the poorest of the poor, has his case more scientifically studied, more exactly measured, more precisely treated than most rich patients in sumptuous homes.

Again, the individual instruction to which President Eliot referred is now carried out in all of our best medical school hospitals by the establishment of small ward-classes, by whom or before whom the patients are examined, prescribed for, and operated upon by the professor or instructor, each student bearing a part; and so, by having his investigations directed, his powers of observation cultivated, his mistakes pointed out, his merits applauded, the student graduates from the medical school equipped as none of us older graduates, alas! ever had the opportunity for. All of these laboratory and ward-classes imply an enormous increase in the number of assistants, young men striving not only to perfect themselves, but, by teaching, to forge to the front so that the best men will win in the struggle for preferment.

Again, the course of study has been prolonged from two years, as it was until twenty or twenty-five years ago, to four years, and in addition the terms have also been lengthened. When I was a student the course of study consisted of two sessions of about 19 weeks each, or 38 weeks in all. Now the course consists, as a rule, of four sessions of 32 weeks each, or a total of 128 weeks, an increase of 90 weeks,—nearly three and one-half times as much as twenty-five years ago. In 1885, 103 schools had courses of two years, and 5 schools courses of three years. In 1899, 2 schools had courses of two years, 10 of three years, and 141 of four years.*

It can be easily seen that from this additional time required another source of expense has arisen in addition to the increased number of assistants. The time given to teaching by members of the faculty, as a rule, has been more than tripled, as compared with twenty-five years ago. In addition to this, professors in charge of laboratories must practically give their whole time to the work and are precluded, therefore, from any income from practice. These men must receive salaries sufficient for them to live upon.

Surely this statement of the difference between the education given twenty-five years ago, which required but little expenditure of money and resulted in considerable incomes, and the modern methods of education in the laboratory and the hospital, as well as the lecture-room, which require enormous expenses, is an ample reason for large endowments.

But the function of the medical school, as I have said, should not be limited merely to the imparting of existing knowledge. No school is worthy of the name that does not provide for greater or less research work by which substantial additions to our knowledge may be made and the facilities and the results of the healing art made more efficient for the welfare of mankind. Twenty-five years ago there were practically few young men who were fitted for research work, especially laboratory work. Now every well-equipped school has attached to it in one way or another a score or more of young men who are eager for work, longing for the opportunity for usefulness and distinction if they can only obtain a bare living.

* Monographs on Education in the United States, No. 10, Professional Education, James Russell Parsons, Jr., Department of Education for the United States Commission to the Paris Exposition of 1900, p. 11.

When in my own school I look around me and see these young men thirsting for opportunities for usefulness and distinction, I am often heartsick at our want of facilities for this purpose, and I long with an intense longing for some wise and munificent friend of humanity who will endow postgraduate scholarships, and laboratories for just such an end. Our hospitals do a magnificent work in charity, helping the sick and the forlorn, the weak and the suffering in a way which appeals to the charitable instincts of our fellow-countrymen, and to this appeal they have responded most generously. *But I venture to say that the medical school which trained a Lister, a Pasteur, a Koch, has done more for humanity than all the hospitals of this country combined.* The modest laboratory at Würzburg consisted chiefly of a Ruhmkorff coil and a Crookes' tube—and Roentgen. Other Roentgens and Listers we have among us if we but knew it. These are the men who are the world's real illustrious heroes.

It is especially in these days that in America we need such researches, for our tropical possessions have brought us face to face with new problems which we can only justly meet by the most careful investigations. It is to our credit that several of our medical colleges have already established schools of tropical medicine, which show that the profession, as well as the public, are rising to the level of our responsibilities and duties.

It is also a cheerful sign of the times that at Harvard a School of Comparative Medicine has been established, which will lead to other similar schools in connection with our medical colleges for the broad study of disease both in man and in the lower animals. All such knowledge should be correlated, and we may well learn from the diseases of animals how to care for man, as thus far we have learned chiefly from the diseases of man how to care for animals. The endowment of this school with the modest sum of $100,000 is an omen of future good. So, too, the somewhat similar school at Buffalo bids fair to add immensely to our knowledge and therefore to our ability to heal.

What now has the American public done for the medical school? Let us contrast it with the endowments in theology. Our academic institutions have such an enormous sum-total of endowments that I do not even consider these. Let us, however, compare theology and medicine, remembering that theology is almost wholly a literary study, dealing not with the facts of nature, requiring no laboratories and no large corps of assistants and therefore conducted at a minimum of cost. In 1898 (United States Education Report) 84 theological schools reported endowments of $18,000,000; 71 schools do not report this item: 19 out of 151 medical schools report endowments of $1,906,072. Five theological schools have endowments of from $850,000 to $1,369,000 each. Yet in 1899 there were only 8000 students of theology for whom this enormous endowment was provided as against 24,000 students of medicine. Each theological student had the income of an endowment of $2250 provided for his aid; each medical student the income from $83. As against 171 endowed chairs of theology there were only 5 in medicine.

I do not grudge a dollar to the theologian, but I plead for his medical brother that, with a vastly more expensive education, he shall have a reasonable provision made for his training.

I have already indicated to some extent the direction which these endowments of medical schools should take. They may be classed in three categories:

First, the endowment of professorships. By doing this the present salary of the professor would be made available for the other wants of the school. The endowment may well take the form of a memorial, either of the generous donor, or, still better, of some distinguished former occupant of such a chair whose name would always add luster to it.

Secondly. The endowment of the laboratories which, as I have indicated, are so costly, both in their installation and in their yearly expenses.

Thirdly. The endowment of post-graduate scholarships and research fellowships, these being intended especially for those who will devote their time to original research. Students cannot take much time for original research; their regular studies absorb all their energies. Research must be done chiefly by young graduates under the direction of stimulating and energetic members of the faculty.

It is not, I trust, too much to hope, if not now, that in the near future the American Medical Association will set a fruitful example by giving each year "Scientific Grants in Aid of Research." The first object of the Association must be, necessarily, to place itself on a strong financial basis. It should own its own building, its printing and publishing plant, and, as soon as possible, should have a reserve fund of considerable proportions. Nothing conduces to the stability and conservativeness of any institution like a good bank balance. The British Medical Association has to-day an excess of assets over liabilities of nearly $380,000, chiefly invested in its building at 429 Strand, London. The American Medical Association has made a fair start with a surplus of over $27,000 last January, and, with its large and, let us hope, rapidly increasing membership, it will before long assume a rank second only to the British Medical Association. Last year* the Scientific Grants Committee allotted £741, or somewhat more than $3500, for research work, distributed to three research scholarships, the holders of which were paid $750 each a year, and 33 grants in aid of research work, varying in amounts from $25 to $100. Among those to whom grants were made occur the well-known names of Beevor, Vaughan Harley, Kanthack, Leuff, Manson, Noel Payton, and Risien Russell. I should hope that the American Medical Association might even now begin by a modest appropriation,

* British Medical Journal, 1899, ii, p. 219.

say of $500 a year, which should be allotted by the trustees, or by a special Committee on Scientific Grants, after a careful investigation of the merits and the character of the person to whom such grants were made. No grant should exceed $100, or possibly even, at first, $50 in amount. The results of such grants would be not only absolute additions to our knowledge, but the cultivation of a scientific spirit which would permeate the whole profession and elevate its objects and aims.*

In pleading for these endowments of medical schools, it is but a plea for a return to the profession of a tithe of what they have given. Two years ago I carefully investigated the value of the services rendered to the poor in the city of Philadelphia by the medical staff of the Jefferson Medical College Hospital alone, and I found that 129 medical men were then attached to the hospital and their services, calculated on a very moderate basis of the ordinary fees, I valued at over $500,000. To a profession which gives so freely of that which is most difficult to give, its own life-blood, surely the public for its own protection may give reasonable endowments to the medical schools. It will be returned to the community tenfold in better educated, better trained, and more successful doctors. More devoted, self-sacrificing men and women they never can have.

* I am glad to say that the Association has made such Annual Grants ever since this address, and they are already bearing good fruit.—(W. W. K., 1905.)

THE IDEAL PHYSICIAN.*

WHEN casting about for a suitable topic on which to address you, I was much perplexed at first, but finally bethought me that perhaps I could not do you a better sevice than to sketch in very brief outlines the characteristics of the ideal physician. Let me address you, therefore, as aspirants for the realization of this ideal.

Few of us, perhaps, at the close of life, can say that we have realized our ideals. But unless we have a high ideal, the trajectory of our life will never have risen to any noble height. "Hitch your wagon to a star," said Ralph Waldo Emerson. Even though you fail you will more nearly reach the firmament than if you had never made the attempt.

The physician may be regarded from three points of view: (1) His personal life; (2) his professional life; and (3) his public life.

Personal Life.—The ultimate basis of esteem is personal character. Wealth for a time may lend its glamour; intellectual attainments for a time may dazzle the judgment; power for a time may achieve apparent success, but when the testing time comes, as come it must to every man when some great temptation to do wrong confronts him, wealth and intellectual power are as if they were not; character is the one thing that tells in this life and death struggle. Having that, you will win the fight and be crowned with the laurel of

* The Commencement Address delivered to the students of Rush Medical College in Affiliation with the University of Chicago, June 21, 1900. Reprinted from the Journal of the American Medical Association, June 23, 1900.

victory. Wanting that, you will succumb, defeated and dishonored. The struggle may be a public temptation known of all men, and if you fall your fall will be like that of Lucifer; or it may be hidden in your own breast, known only to God and yourself; but if you win, the victory, measured by the eyes of Omnipotence, is just as great, for a character has been saved and strengthened, a true man has attained his growth.

It is due, I am glad to say, to this prevalence of high character that our profession has won such a lofty place in the esteem of the community. Its purity is almost never impeached. Remember that every time you are alone with a woman-patient in your consulting room, with every eye barred out, she gives her honor into your hands and in turn you place your reputation unreservedly in hers. A whisper will destroy either or both of you. In my opinion, it is the highest tribute that can be paid to the character of our profession and equally to the credit of our patients that this mutual confidence is so seldom abused and the tongue of scandal is so seldom busied with noxious tales. When you remember that there are over one hundred thousand physicians in this country, with daily possibilities of wrong-doing, is it not marvellous that this sacred trust is so jealously conserved?

Greatness of character finds its best expression in kindness. To no one are so many opportunities for this fine trait given as to the physician. In the heyday of health and happiness he is not needed, but when sickness and weariness and woe come, when the bread-winner may be taken, or the loved mother's gentle life may be in peril, or a sweet little child in whom is centered all the tenderness of unbounded love is lying ill, and death seems to dog the doctor's footsteps, then the trusted physician, wise of head and kind of heart, is indeed a welcome visitor. Then can his gentle touch give assurance; then can his sympathetic voice bring hope; then can the thousand and one acts of thoughtful kindness bind to him for life the anxious hearts looking to him as the messenger of life. Even in the daily routine of a hospital clinic, a kind word is often better than any medicine.

Manners make the man. The boor has no place among us. The physician should never be the fop, but always the gentleman; never unclean of clothes or speech, but always neatly dressed and so careful of his words that he need not ask, as did one of General Grant's aids, when about to tell a questionable story: "There are no ladies present, are there?" "No," was Grant's stinging reply, "but there are several gentlemen." Soiled linen and unclean finger-nails are as much condemned by antisepsis as they are by decency. The flavor of stale tobacco smoke about his beard and clothes will never characterize the ideal physician, nor will indulgence in alcohol ever cloud his judgment or disgust his patients.

Make it a point not to let your intellectual life atrophy through non-use. Be familiar with the classics of English literature in prose and verse; read the lives of the great men of the past, and keep pace with modern thought in books of travel, history, fiction, science. A varied intellectual life will give zest to your medical studies and enable you to enter not unequipped into such social intercourse as will beget you friends and will relieve the monotony of a purely medical diet. Let music and art shed their radiance upon your too often weary life and find in the sweet cadences of sound or the rich emotions from form and color a refinement which adds polish to the scientific man.

I suspect the next characteristic of the ideal physician will meet with a ready assent,—marry as soon as you can support a wife and the hostages to fortune who will make your home life happy beyond compare. But choose wisely and not too hastily. A bachelor doctor is an anomaly. He cannot fully comprehend the hopes and fears and desires of parents. He knows not the lions in the path of childhood. Imagine, if you can, some sweet lassie confiding to him the symptoms of a heart disease which digitalis cannot cure. The ideal physician is a good husband and a good father, and so will he enter into the lives and hearts of parents and children, not as a stranger, but as one who can partake of all their emotions, because he has felt the same joys, partaken of the same sorrows, loved as they have loved, and, it may be, drunk to the dregs the same cup of loss.

But the ideal doctor lives also a spiritual life. You gentlemen will have to deal with the entrance and the exit of life. You must often ask yourself what and whence is this new *ego* that is born into the world; whither goes the spirit when it quits this tabernacle of flesh which is left to moulder and decay. The tremendous problems of life and death are daily put before you for solution. You cannot avoid them if you would; they are forced upon you by your daily occupation.

As man to man, may I not ask you to give them that consideration which befits the highest problem that can be presented to any human being. That this life, with its hopes and its joys, its diseases and its disasters is all, is denied alike by common sense, by reason, and by revelation. He is the best physician who takes account of the life hereafter as well as the life that now is, and who not only heals the body, but helps the soul. Let your lives, therefore, be thoroughly religious, religious in your inmost soul, though often you may be denied its customary outward observances. Then shall character, which was my first postulate for our ideal physician, find expression in an ideal altruistic life.

Professional Life.—The ideal physician is a member of a learned guild. He should be above the tricks and petty jealousies of trade. True, he lives by his profession, but he who practices for gain is only a hireling and not a true shepherd of the sheep. If you would attain, therefore, to this professional ideal, you must be a constant student, keeping abreast of that scientific progress of which in your community you must be the exponent. You must not be satisfied with the knowledge which you now possess; you must read, especially the medical journals, or you will be left behind in this day of rapid progress. You must know not only your own language, but must be familiar, at least by a reading knowledge, with French and German, and if possible with other tongues. He who knows two languages is twice the man he was when he knew but one.

You must not only be skillful, but careful. I have made not a few mistakes in my own professional life, and in reviewing them I can see that for every one made by reason of lack of knowledge and skill, two at least have been committed by haste or want of care. With all our varied instruments of precision, useful as they are, nothing can replace the watchful eye, the alert ear, the tactful finger, and the logical mind which correlates the facts obtained through all these avenues of information and so reaches an exact diagnosis, institutes a correct treatment, and is rewarded by a happy result.

Be careful in your relations to your patients to deal with them conscientiously. In no other calling is the amount of service to be paid for committed absolutely to the judgment and conscience of the person who is to be paid for his services. Whether you shall make few or many visits is left to your discretion and honest judgment. Sordid motives may occasionally lead to the giving of unnecessary attention. But again it is a glory of our guild that very few physicians betray this trust, and those who do quickly lose their professional standing. Watch yourselves jealously in this respect, and never let the greed of gain dull the fine edge of professional honesty.

You will be the father confessor to many a penitent. Family skeletons will be unveiled to you alone. The conscientious duty of professional secrecy is given, I am proud to say, into not unworthy hands. True, physicians are sometimes too lax in the repetition of petty gossip, but the profession as a whole is worthy of the confidences so freely given. Be careful, even to reticence, of any betrayal of this trust. Better suffer misconception and unmerited blame yourselves than betray your patients.

Be brave men. Your fathers were brave men. When pestilence stalks in the streets and contagion lurks in every chamber of illness, where have the doctors been found? Fleeing from danger with the frighted multitude? Nay, verily. If you wish to find them you must seek in the crowded tenements, in the hospitals, and in the charnel-houses. There you will find them cheerfully tending the sick, facing disease in the midst of its victims, and seeking, even in the bodies of the dead, the knowledge that will make them masters of the plague. Witness Rush in the yellow fever of 1797, Gross in the cholera of 1832, and Haffkine in the bubonic plague of the present time. War has given us many fine examples of personal bravery, but pestilence has bred its quiet heroes who have gone about their daily duty, simply, fearlessly, devotedly. No granite shaft, no enduring brass may mark their last resting-place, but the Recording Angel has dropped a tear, blotting out their faults, and writ their names high in the roll of fame.

In your professional relations, never forget to be charitable. The best patients you will ever have will be the thankful poor, and your hearts will often find a sincere and grateful glance better payment than any gold. In your relations with other physicians, you will find many opportunities for that same brotherly kindness which is so beautiful a characteristic of our guild. Always extend to other physicians and their immediate families the courtesy of faithful attendance without pecuniary return. Avoid the petty jealousies, which, I am sorry to say, not seldom estrange physicians from each other. Always believe the best motive unless you know the worst is present. Never say an unkind word of a brother-doctor when you can utter a kindly one. Try to be just, even to those who are unjust to you.

Public Life.—In most communities, especially in minor towns and villages, the doctor is one of a small circle of educated men. His scientific studies make him familiar with many public problems, especially those concerning sanitation, the water-supply, the prevention of epidemics, the preservation of the public health, the problems of school life, the fostering of a proper athletic indulgence, the management of prisons, the care of the feeble-minded, the insane, the poor. On all of these questions you must make your voices heard in the communities in which you live or else you give them over to others less qualified and only mischief can follow.

No one, perhaps, is more of a leader than the physician in the various philanthropic enterprises of the day. These are closely allied in many respects to the topics just mentioned, and you will be on boards of directors and managers and trustees where you must bring your influence to bear for a wise outlay of charitable gifts and civic appropriations and for harmonizing the antagonistic elements which too often produce discord and confusion. If you combine the qualities which I have sketched for the ideal doctor, you will find that men will easily recognize you as wise leaders whom they will be glad to follow.

My best wish for you is that you may realize in your own lives these characteristics of the ideal physician. It will matter little then whether your life be long or short, for the proper measure of a life is not how long, but *how* it has been lived, and if you attain to old age, when the hairs whiten and the crow's feet begin to show, when your natural forces are abated, you will then not be alone in the world, but will have honor, love, obedience, troops of friends, and one Friend above all others, the Great Physician. And when you pass from this life into the next, then shall you be greeted not only by this one great Friend, but by many from whose pathway you have plucked the thorns and briars of this earthly life; many whom, through the devious paths of convalescence, you have led back to perfect health, to home, husband, father, mother, children; and even if you have not been able to stay the hands of the grim reaper, those too will greet you whose last hours you have soothed amid the pangs of death and have helped through the new birth into the heavenly Jerusalem.

ADDRESS AT THE ROYAL COLLEGE OF SURGEONS OF ENGLAND AT THE CONFERRING OF HONORARY DEGREES AT THE CENTENARY CELEBRATION OF THE GRANTING OF ITS PRESENT CHARTER.*

ON behalf of my American colleagues and myself it gives me great pleasure to return our very hearty thanks for the honor just conferred upon us. We regard it as the highest surgical honor we could receive, for "Praise from Sir Hubert is praise indeed."

Though the Royal College of Surgeons of England has attained a venerable age, it is far from decrepitude. No better evidence of this can be found than the many Members and Fellows who at the call of duty so cheerfully went to the front in South Africa. Foremost among them was your distinguished President, who, though he has reached an age when most men seek repose and slippered ease, responded to his country's call with his customary energy and alacrity. Happily the war is now nearing its end. Apart from any political results in South Africa, it has had two results in which we may well rejoice. It has bound together Great Britain and her colonies in one solid empire; and through the wise statesmanship of the Most Noble the Marquis of Salisbury and His Excellency the American Ambassador has joined Great Britain and America in a firm moral union in which Her Majesty, if not monarch of our persons, is surely Queen of our Hearts.

* Reprinted from the British Medical Journal, August 4, 1900.

We come to you as representatives of four of our great institutions of learning—from Harvard, hoary with the snows of nearly three centuries, to Johns Hopkins, in the lusty youth of less than three decades. As President of the College of Physicians of Philadelphia I represent also the oldest institution in America at all similar to your own, a Corporation which includes surgeons as well as physicians, and which was already in its teens when the Royal College of Surgeons received its present charter.* On behalf of these and of all our medical institutions we bring you our heartiest greetings on this festal occasion, in the name of sound learning and accurate scholarship.

It has been my pleasure in Philadelphia to welcome many of your Fellows, including three of your most distinguished Presidents. Some of you have even swept across the continent in luxurious palace cars in but little over one hundred hours. To show how swift has been our progress and yet how young we are, I need but recall the fact that this College was nearly forty years old before the name of Chicago—now a city of nearly 2,000,000 people—even appeared upon the map, and, when you were founded, beyond the fringe of civilization on the Atlantic coast practically the only inhabitants of the vast region from the Alleghanies to the Golden Gate were the buffalo, the bear, and the savage Indian.

But though so young we come not empty-handed. Three

* The Royal College of Surgeons of England was founded originally in 1540 in the reign of Henry VIII. By a misfortune they lost their charter in 1796. A new one was granted to them in 1800 by George III. In 1900, to celebrate the centenary of the granting of this new charter, they conferred their Honorary Fellowship upon the Prince of Wales (now King Edward VII), Lord Salisbury, Lord Rosebery (the leaders of the Conservatives and the Liberals), and thirty-two surgeons from various countries in Europe and America. My address was the response on behalf of the American surgeons upon whom the degree was conferred; namely,—J. Collins Warren, of Harvard; Robert F. Weir, of Columbia; William S. Halsted, of Johns Hopkins; and W. W. Keen, of the Jefferson Medical College. [W. W. K., 1905.]

great medical advances mark the past one hundred years—vaccination, anæsthesia, and antisepsis. The first and third of these are yours, but the second—anæsthesia—better than Magian gold and frankincense and myrrh, is the gift which to-day America lays on the altar of science.

Before that historic date, October 16, 1846, the poor victims of the knife were bound hand and foot and held in the grasp of sturdy men; but hand and cord could not repress the fearful outcries which filled the air. But at Warren's touch the thongs fell off; he spoke, and the stormy billows of this Gennesaret of pain were stilled; the peaceful, blessed sleep of ether hushed every cry of pain. Then first was modern surgery made possible, and what was made possible by our Warren was made safe and successful by your Lister—no, not your Lister, but *our* Lister, for his name belongs to no age and no country, but to humanity.

It is, therefore, with a special fitness that to-day you have conferred your Honorary Fellowship upon the distinguished grandson of him who first demonstrated the blessings of ether to a suffering world. At the very time when this College was founded Warren was a student of Guy's Hospital and his certificate of attendance, signed by Mr. Cline and Sir Astley Cooper, is in the possession of his grandson.

Again, Mr. President, I beg you to accept our sincere thanks for the distinguished honor you have conferred upon us.

THE PROGRESS OF SURGERY IN THE NINETEENTH CENTURY *

THE end of the eighteenth century was made notable by one of the most remarkable and beneficent discoveries which has ever blessed the human race,—the discovery of the means of preventing small-pox. On May 14, 1796, Dr. Edward Jenner inoculated James Phipps. When we remember that 2,000,000 persons died in a single year in the Russian Empire from small-pox; that in 1707 in Iceland, out of a population of 30,000, sixty per cent., or 18,000, died; that in Jenner's time "an adult person who had not had small-pox was scarcely met with or heard of in the United Kingdom, and that owing to his discovery small-pox is now one of the rarest diseases," the strong words I have used seem fully justified. But the eighteenth century was not to witness the end of progress in medicine. The advances in the nineteenth century have been even more startling and more beneficent. What these advances have been in the department of medicine has been related by Professor Osler. It is my province to speak only of surgery.

I. Method of Teaching.

The first advance which should be mentioned is a fundamental one,—namely, methods of medical teaching. At the

* Early in 1901 the New York Sun published a series of articles on the advances made during the nineteenth century in various departments of knowledge. The papers were republished by Harper & Brothers in a volume entitled The Progress of the Century. I am permitted to reproduce my own contribution to this series by the kind permission of Paul Dana, Esq., the editor of the Sun, and of Messrs. Harper & Brothers.

beginning of this century there were only three medical schools in the United States: the medical department of the University of Pennsylvania, established in 1765; the medical department of Harvard, established in 1783; and the medical department of Dartmouth, established in 1797. The last report of the Commissioner of Education gives a list of 155 medical schools now in existence in this country, many of them still poorly equipped and struggling for existence, but a large number of them standing in the first rank, with excellent modern equipment, both in teachers, laboratories, hospitals, and other facilities. The medical curriculum then extended over only two years or less and consisted of courses of lectures at the most by seven professors, who, year after year, read the same course of lectures without illustrations and with no practical teaching.

The medical schools, even when connected with universities, were practically private corporations, the members of which took all the fees, spent what money they were compelled to spend in the maintenance of what we now should call the semblance of an education, and divided the profits. Until within about twenty years this method prevailed in all our medical schools. But the last two decades of the century have seen a remarkable awakening of the medical profession to the need of a broader and more liberal education, and that, as a pre-requisite, the medical schools should be on the same basis as the department of arts in every well-regulated college. To accomplish this the boards of trustees have taken possession of the fees of students, have placed the faculties upon salaries, and have used such portion of the incomes of the institutions as was needed for a constant and yet rapid development along the most liberal lines.

II. College Hospitals.

The first step has been the establishment, in connection with most schools, of general hospitals in which the various teachers in the college should be the clinical instructors and where the students would have the means not only of hearing theoretically what should be done to the sick, but of actually examining the patients under the supervision of their instructors, studying the cases so as to become skilled in reaching a diagnosis and indicating what in their opinion was necessary in the way either of hygiene, medicine, or surgical operation. More than that, in most of the advanced schools to-day the students assist the clinical faculties of the hospitals in the actual performance of operations, so that when they graduate they are skilled to a degree utterly unknown twenty years ago.

III. Establishment of Laboratories.

Another step which was equally important, and in some respects even more so, has been the establishment of laboratories connected with each branch of instruction. A laboratory of anatomy (the dissecting-room) every medical school has always had, but all the other laboratories are recent additions. Among these may be named a laboratory of clinical medicine, a laboratory of therapeutics, in which the action of drugs is studied; a laboratory of chemistry; a laboratory of microscopy; a laboratory of pathology, for the study of diseased tissues; a laboratory of embryology, for the study of the development of the human body and of animals; a laboratory of hygiene; a laboratory of bacteriology; a laboratory of pharmacy; a surgical laboratory, in which all the operations of surgery are done on the cadaver by each student; a laboratory of physiology, and in many colleges private rooms in which advanced laboratory work may be done for the discovery of new truths.

In all these laboratories, instead of simply hearing about the experiments and observations, each student is required to handle the drugs, the chemicals, the apparatus, to do all the operations, to look through the microscope, etc.; in other words, to do all that which is necessary for the proper understanding of the case in hand. In fact, it may be said that, in view of the opportunities and the requirements of modern hospitals, it is undoubtedly true that a hospital patient, the poorest of the poor, often has his case more thoroughly studied and more carefully treated than the wealthy patient who is attended at his home. On the other hand, however, so many laboratories with their expensive apparatus and a large staff of assistants mean an enormous increase in the expense of a medical education, for which the student does not pay anything like an equivalent. Hence the need in all of our best modern medical schools for endowments, in order that such work may be carried on properly and yet the student not be charged such fees as to be practically prohibitory, excepting for the rich or, at the least, the well-to-do. I do not hesitate to say that by reason of these facilities at the end of the second year many a diligent student of to-day is better fitted to practise than was the graduate of half a century ago.

IV. Anatomical Material.

One of the most important means of the study of medicine, and especially of surgery, is a thorough acquaintance with the anatomy of the human body. No one would think of placing a complicated piece of machinery in charge of an engineer who had never become intimately acquainted with all the parts of such a machine and could take it to pieces and put it together again with ease and intelligence. Yet, until comparatively recently, this knowledge of anatomy was both required, and yet at the same time the means of obtaining it were forbidden, the medical student. If he performed an operation and was guilty of negligence or error, due to his want of anatomical knowledge, he was liable to a suit for malpractice. Yet his only means of becoming acquainted with the anatomy of the human body was by stealing the bodies of the dead. In

England, up to 1832, this was equally true. A regular traffic in human bodies existed there as well as here, and by reason of its perils the cost of bodies for dissection was very great; but it was only a question of money. In his testimony before the Parliamentary Committee, Sir Astley Cooper made a shiver run down the backs of the noble Lords who listened to him when he said that in order to dissect the body of any of them it was only necessary for him to pay enough. The large pecuniary profits of such business, when the supply was very small, led to the horrible atrocities of Burke and Hare in Edinburgh in 1832. They deliberately murdered a considerable number of persons, and sold the bodies to the dissecting-rooms in that city.

The discovery of their crimes finally led to the passage of the Anatomy act, which has been in force in Great Britain ever since. Similar violations of graveyards in this country have led to the passage in various States of somewhat similar laws, usually giving for dissection the bodies of those who were so poor in friendship that no one would spend the money necessary for their burial. But even to-day, in a large number of our States, the former anomalous condition of affairs still exists. The increase of anatomical material which has resulted from the enactment of wise and salutary laws for this purpose has given a great impetus to the study of anatomy, and has produced a far better educated class of physicians in most parts of the United States within the last few years. The enlightened sense of the community has perceived that to deny the medical schools the means of properly teaching anatomy was a fatal mistake and resulted in an ignorance of which the community were the victims. As a result it is possible now, by law, in most States to obtain a reasonable number of cadavers, not only for the study of anatomy, but for the performance of all the usual operations.*

* For the atrocities of Burke and Hare see pp. 20–22. For the Pennsylvania Act the best of all the Anatomy Acts see p. 14, footnote.

V. Medical Libraries.

Along with this there has been throughout this country a marked movement in favor of medical libraries. It is to the credit of the Government of the United States that the whole world is debtor to us, not only for the foremost medical library in the world, that of the Surgeon-General of the Army in Washington, but also for the magnificent Index-Catalogue not only of the books, but of all the journal articles in every language in the world. No better investment of money was ever made than the establishment of this library, and its allied museum, and the publication of the Index-Catalogue.

VI. Embryology.

As a result of all these means and methods of study, and as a part of the great educational and scientific movement of the century, medical men now take a wholly different view of the normal and abnormal structures of the human body. The study of embryology has shown us that many of the deviations from the normal development of the human body are easily explained by embryology. One of the most important changes in our idea, for example, of tumors is due to the fact that the study of embryology, and of the tissues of the embryo, has shown that diseased structures which entirely lack explanation when compared with the adult human tissues readily find their explanation, and fall into an unexpected order, when compared with the tissues of the embryo. Not only, however, has the study of embryological tissues thrown a flood of light on diseased structures, but we have obtained new views of the relation of man to all creatures lower in the scale of life. Largely owing to the doctrine of evolution, we now recognize the fact that, so far as his body is concerned, man is kindred to the brutes; that his diseases, within certain limitations, are identical with similar diseases of the lower animals; that his anatomy and physiology are, in essence, the same as the anatomy and physiology of the lower animals,—even the very lowest,—and that many of his diseases can be best studied in the lower animals, because upon them we can make exact experiments which would be impossible in man. While it is true that each animal has disorders which are peculiar to itself, and that it is not subject to some of the disorders to which man is a victim, and, *per contra*, that man is a victim to some disorders which animals do not suffer from, yet, taking them as a whole, the diseases of man and of animals, and the action of remedies on both are practically identical. To this I shall have occasion to refer again.

VII. Pathology.

Among the laboratories which I mentioned, one of the most important is that of pathology and morbid anatomy, or the study of diseased tissues and organs. The first work on pathology in this country was written by one of our best-known surgeons, the late Samuel D. Gross, and one of his most important contributions to surgical progress consisted in his persistent advocacy of the need for the study of pathology as a basis for all our means of cure. This is evident, if we consider the illustration I used a moment ago of a steam engine. Unless one knows precisely the defects of such a machine, the influence of fresh or salt water on a boiler, the influence of rust, the effect of oils, entirely apart from the mere mechanism of the engine, an engineer might make the most serious mistake resulting in fatal damage, both to the machine and probably to life. So surgical pathology is the study of the processes of disease, the alterations in the minute structure of tissues and organs, without which no surgeon can be fitted for his task, much less can he be called an accomplished surgeon. All of these laboratories mark the difference between the scientific and the empirical method. The old student of medicine went from case to case, heard many a good maxim and learned many a useful trick, but, after all, it was only an empirical knowledge which he obtained. It did not go to the foundation of things. It was not scientific, as is the collegiate instruction of to-day.

Having thus glanced rapidly at the improvement in medical instruction, let me turn now to a few of the principal discoveries which have made the surgery of to-day so much superior to the surgery of a hundred years ago.

VIII. Anæsthesia.

After vaccination, the next most important surgical event of the century was the discovery of anæsthesia. While there were some prior attempts at anæsthesia, practically it dates from October 16, 1846, when Dr. John C. Warren, in the Massachusetts General Hospital, first performed a major surgical operation without inflicting the slightest pain. I cannot enter into the merits of the various claimants for the credit of first using an anæsthetic, but ether was then for the first time publicly administered by Morton, and the very sponge which was then used is now a precious trophy of the Massachusetts General Hospital. I may perhaps quote from an address which I delivered before the Medical and Chirurgical Faculty of the State of Maryland at their centennial anniversary in April, 1899 (p. 271) the following in relation to anæsthesia:

> The news went like wildfire, and anæsthesia was soon introduced into every clinic and at almost every operation throughout the civilized world. Prior to that time a surgical operation was attended with horrors which those who live in these days cannot appreciate. He was the best surgeon who could perform any operation in the least possible time. The whole object of new methods of operating was to shorten the period of frightful agony which every patient had to endure. Every second of suffering saved was an incalculable boon. To submit to any operation required then a heroism and an endurance which are almost incomprehensible to us now. All of the more modern, deliberate, careful, painstaking operations involving minute dissection, amid nerves and blood-vessels, when

life or death depends on the accuracy of almost every touch of the knife, were absolutely impossible. It was beyond human endurance quietly to submit one's self for an hour, for an hour and a half, for two hours or even longer, to such physical agony.

It is a striking commentary on the immediate results of the introduction of anæsthesia to learn that, in the five years before the introduction of ether, only 184 persons were willing to submit themselves to such a dreadful ordeal in the Massachusetts General Hospital, an average of 37 operations per annum, or 3 per month. In the five years immediately succeeding its introduction, although the old horror could not at once be overcome, 487 operations, or almost 100 annually, were performed in the same hospital. During the last year in the same hospital,—a Mecca for every surgeon the world over,—over 3700 operations were performed. It is not an uncommon thing at the present day for any one of the more active surgeons of this country to do as many as 400 to 500 operations in a year. I have known as many as 19 operations to be done in the Jefferson Medical College Hospital in a single day—equalling six months' work in Boston before the introduction of ether.

The next year, 1847, witnessed the introduction of chloroform by Sir James Y. Simpson, of Edinburgh. Until I became acquainted with the striking figures just quoted I had often wondered at the hospital scene in that most touching story, "Rab and His Friends," by the late gifted and well-beloved physician, Dr. John Brown, of Edinburgh. Nowadays students do not rush into the surgical amphitheatre when they learn that an operation is to be done, but it is taken as a matter of course, for practically every day many operations are done in most of our large hospitals. But, at the time when Rab's mistress was operated upon, an operation, as has been stated, was a very rare event. Few had the fortitude to endure its dreadful pangs. Now, thanks to the blessed sleep of anæsthesia, sufferers from even the most dreadful disorders can have long and difficult operations done, accurate and tedious dissections made, and yet feel not a twinge of pain.

Besides general anæsthesia by ether, chloroform, and a few other agents, there have been introduced several means for producing "local anæsthesia," i. e., agents which destroy the sensibility of the part of the body to be operated upon while not producing unconsciousness. Freezing the part by ice and salt and by a quickly evaporating spray of rhigolene or chloride of ethyl are sometimes used. But cocaïne and a somewhat similar substance, eucaïne, have of late been more extensively used on man, after their harmlessness had been first shown by experiments on animals. In 1885 Corning, of New York, injected a solution of cocaïne as near to the spinal cord as was possible and produced insensibility of all the body below the point of injection by the effect of the cocaïne upon the spinal cord. A few years ago Quincke, of Kiel, in Germany, devised a means of puncturing the spinal canal itself in the lumbar region (the lowest part of the small of the back) for the purpose of drawing off some of the fluid for examination.

This suggested to Bier, then of Kiel, who was apparently ignorant of Corning's work, that cocaïne could be injected through a hollow needle inserted into the spinal canal by "lumbar puncture" and so produce anæsthesia of all the body below this point. This method was published by him in 1899 and was soon repeated in America. In France, however, it has been practised more than elsewhere, Tuffier, of Paris, having successfully done over two hundred operations by "spinal anæsthesia." All of the body below the diaphragm can thus be deprived of sensibility. The method will probably never replace ether and chloroform, but in many cases is a valuable aid to the surgeon. But it has its dangers and its inconveniences. The ideal anæsthetic is not that which destroys sensibility and yet leaves the patient perfectly conscious, as spinal anæsthesia does. A patient to whom I recently proposed it for certain special reasons rejected it, saying, with probable truth, that she could never bear the strain of lying on the table perfectly conscious of all that was being done and frightened by any surgical emergency which might easily arise in such a long, difficult, and dangerous operation. The ideal anæsthetic is that which will abolish pain and consciousness without danger to life. The twentieth century will undoubtedly see the discovery of this safe and efficient anæsthetic.

IX. Antisepsis.

But we have not yet reached the limits of surgical progress. Let me quote again from the address before alluded to:

Even the introduction of anæsthesia, however, did not rid surgery of all its terrors. The acute pain of the operation was abolished, but the after-suffering, as I know only too well, in my early surgical days was something dreadful to see. The parched lips of the poor sufferer, tossing uneasily during sleepless nights; wounds reeking with pus, and patients dying by scores from blood-poisoning, from erysipelas, from tetanus, from gangrene, were only too familiar sights in the pre-antiseptic days. Then, again, there arose one of these deliverers of the human race whose name can never be forgotten and whose fame will last so long as time shall endure. Jenner, Warren, and Lister are a triumvirate of names of which any profession may well be proud. Thank God, they all sprang from virile Anglo-Saxon loins! No praise, no reward, no fame, is too great for them. That Lord Lister lives to see the triumph of his marvellous services to humanity is a joy to all of us. And when the profession arose *en masse*, within the last few years at the International Congress of Berlin and at the meeting of the British Medical Association in Montreal and welcomed him with cheer after cheer, it was but a feeble expression of gratitude for benefits which no words can express.

Before Lister's day erysipelas, tetanus, gangrene, and blood-poisoning in its various phases were the constant attendant of every surgeon. They were dreaded guests at almost any operation; and when in rare cases we obtained primary union without a drop of pus, without fever, and with but little suffering, it was a marvellous achievement. Now it is precisely reversed. The surgeon who does not get primary union without a drop of pus, with no fever, and with little suffering, asks himself: What was the fault in my technic? To open the head, the abdomen, or the chest thirty years ago was almost equivalent to signing the death warrant of a patient. The early mortality of ovariotomy was about 60 per cent.; 2 out of 3 died. Now many a surgeon can point to a series of 100 abdominal operations with a fatality of only 2 or 3 per cent.

This, too, is a direct result of laborious laboratory researches, beginning with the investigations of Liebig and Pasteur on fermentation. Lister went still further. Even before the discovery of the bacteria of suppuration, of tetanus, and of erysipelas, he showed us experimentally how, by surgical cleanliness, we could avoid all infection and so banish these pests from our hospitals and bring life and health to many who otherwise would have perished from operations which are now perfectly safe.

The mortality of compound fractures in the pre-antiseptic days was about 60 per cent. It was one of the most dreaded of all accidents. Its mortality now is perhaps not over 3 per cent. and the mortality from sepsis after such a fracture in the hands of well-instructed surgeons is almost *nil.* Prior to Lister's day, the mortality of major amputations varied from 50 to 63 per cent. Now it is from 10 to 20 per cent. And so I might go on with operation after operation and show how they have become so safe that one need not dread any, saving exceptional, cases.

These two modern discoveries, anæsthesia and antisepsis, have utterly revolutionized modern surgery. They have made possible operations which, by reason of their duration, pain, and danger, were utterly unjustifiable in former days, but are now the daily occupation of a busy surgeon. And, far better than this, they have enabled us to bring to homes and hearts, which otherwise would have been broken up and wrung with sorrow, the comfort of life restored to dear ones upon whom depended the happiness and support of the families. Translate figures into happy hearts and prosperous homes if you can, and then you can tell me what Warren and Lister have done for humanity.

The result of these two wonderful discoveries has been to separate us from the surgical past, as by a great gulf.

Great theologians, such as a Calvin or a Jonathan Edwards, were they recalled to life, could discourse as learnedly as ever of Predestination and Free Will; great preachers, as a Beecher or a Spurgeon, could stir our souls and warm our hearts as of old; great jurists, as a Justinian or a Marshall, could expound the same principles of law which hold good for all time; great forensic orators, as a Burke or a Webster, would convince us by the same arguments and arouse us by the same invectives and the same eloquence that made our fathers willing captives to their silver tongues. But to-day, so rapid has been our surgical progress, a Velpeau, a Sir William Ferguson, or a Pancoast, all of whom have died within the last thirty years, could not teach modern surgical principles or perform a modern surgical operation. Even our everyday surgical vocabulary—staphylococcus, streptococcus, infection, immunity, antisepsis and asepsis, toxine and antitoxine—would be unintelligible jargon to him; and our modern operations on the brain, the chest, the abdomen, and the pelvis would make him wonder whether we had not lost our senses, until, seeing the almost uniform and almost painless recoveries, he would thank God for the magnificent progress of the last half-century, which had vouchsafed such magical—nay, such almost divine—power to the modern surgeon.*

X. The Surgery of War.

One of the immediate consequences of the introduction of the antiseptic method has been a remarkable mitigation of the horrors of war. Our recent war with Spain has proved, and the present military operations in the Philippines and of the British in South Africa will still further prove, its advantages. Witness a little book written by Prof. von Esmarch, of Kiel, Germany, with the apt title "The Fight of Humanity Against the Horrors of War," with an appendix entitled "The Samaritan on the Battlefield." One of the most valuable means for the preservation of human life is carried by every soldier in a modern civilized army as a part of his regulation outfit, a "First Aid Package" for the treatment of any wound or injury, and one of the most valuable and interesting papers read before the American Surgical Association at its meeting in Chicago in 1899 was by Professor Senn on the "First Aid Package." This first aid package contains an antiseptic dressing, which can be applied to all but the gravest wounds for the purpose of preventing infection, which is the principal danger to life after accident or injury. The universal testimony of our surgeons in Cuba was that by its use most wounds were prevented from becoming infected and, therefore, inflamed, and that the number of operations was greatly diminished by reason of its use.

XI. Bacteriology.

In experimental science two methods of progress are observed: first, in actual practice certain methods are adopted

* From my Address in Surgery at the Semicentennial Meeting of the American Medical Association, 1897 (*vide ante* page 243).

because they are found to be the most advantageous and useful, though we cannot explain why it is so,—i. e., practice outstrips theory. Again, as a result of experimental investigation, certain facts are discovered which explain why the practical methods just alluded to are the best, and this in turn suggests further improvements in our practice,—i. e., theory outstrips practice and enlarges its domain. Thus outstripping theory, the practical advance made by Lister was an example of the first. His striking results in turn stimulated scientific observers to make new discoveries of the greatest importance, and thus science immensely improved and widened our practical methods.

No definite year or day can be assigned as the birth date of Lord Lister's antiseptic methods, as we can, for instance, for vaccination or for anæsthesia. We may assume, at least for this country, the summer of 1876 as the starting point. During that year Lord Lister attended the International Medical Congress held in Philadelphia and demonstrated his then methods and convinced a few surgeons of their immense advantages. Even before that date there had been very many experiments and observations, especially on the blood. In 1863 Davaine in France had discovered little rod-like bodies in the blood in wool-sorters' disease or anthrax, which he named from their shape "bacteria," or "little rods." This name has been adopted for all forms of germs, though many of them are not rod-like in their shape. Not until 1881 was the cause of inflammation and suppuration (the formation of pus or "matter") discovered. In that year Ogston, of Aberdeen, published experiments which he believed demonstrated the fact that certain bacteria were the cause of suppuration. Since then this has been amply confirmed not only by experiments upon animals, but by observation in man. In 1882 Robert Koch, of Berlin, discovered the cause of tuberculosis, a little, rod-like body which is named the "bacillus" of tuberculosis. In 1883 Fehleisen discovered the cause of erysipelas, and in 1887 Nicolaier and Rosenbaum discovered the bacillus of tetanus or lockjaw. So recent have been the discoveries in bacteriology which have led to vast improvements in our methods of treatment of wounds and the performance of operations.

While the principles established by Lord Lister have remained unchanged, the details in the treatment have been greatly simplified and made more efficient. For the information of the general reader let me state a few facts. Bacteria are divided into two principal classes, in accordance with their form. One class, known as "cocci," from the Greek word coccus,—"berry,"—may be likened to billiard-balls. Some of these occur in bunches, which have been likened to bunches of grapes, and hence are called, again from a Greek term, "staphylococci." Others are arranged in chains, like beads, and are called "streptococci." These last are very much more virulent and dangerous than the staphylococci. Both of these produce pus or matter, and they are the most widely diffused and most common forms found in infected or suppurating wounds. One form is the cause of erysipelas. A second class, known as "bacilli," may be likened to a lead-pencil. Among the various bacilli that have been discovered are those of tuberculosis, glanders, tetanus or lockjaw, etc. I omit many others found in medical disorders, as they do not concern this paper. How important these discoveries are may be seen by the following facts: Tuberculosis, next to suppuration, is, perhaps, the most widely extended infection to which man, as well as animals, is liable. We are all familiar with it in the form of "consumption," but the non-medical reader is, perhaps, not aware of the fact that it affects not only the lungs, but also the bowels in consumption of the bowels; the bones, as is seen by every surgeon almost daily, and especially as the cause of the crooked backs seen in spine diseases; in the joints, as is seen in hip-joint disease, white swelling of the knee, ankle-joint disease, and similar disease of all the other large joints of the body; in the brain, in tuberculous meningitis; in the abdominal cavity, in tuberculous peritonitis; in the skin, in certain forms of ulceration, commonly called lupus; in the glands, as in the swollen glands, or "bunches" in the neck, and endless other varieties which I need not name.

The bacillus of lockjaw is found in great abundance around stables, and this explains the fact that hostlers, drivers, cavalrymen, all of whom have to do with horses, are especially liable to attacks of lockjaw. The fact was long known; the reason was wholly unknown until 1887. Moreover, certain bacteria thrive best when exposed to the open air. Other bacteria, and among them the bacilli of lockjaw, thrive best when the air is excluded, and this explains the danger of treading on a rusty nail, which is popularly and rightly known as peculiarly liable to produce lockjaw. The reason is not because it is a nail, nor because it is old, nor because it is rusty, but because from the earth in which it lies it is most apt to be the means of introducing into a punctured wound the bacilli of lockjaw. Such a wound bleeds very little, the blood soon crusts and excludes the air, and if any of the bacilli of lockjaw have been carried into the body, they find in such a closed wound, from which the air is excluded, the most favorable conditions for growth and infection of the whole body. Knowing these facts from experiment, the treatment is clear. Lay open such a wound as soon as it is received and disinfect it, and lockjaw will not occur.

These two forms, the "cocci," or berry-like bacteria, and the "bacilli," or rod-like bacteria, comprise the great majority of dangerous bacteria.

It must be remembered that there is an enormous number of bacteria which are not dangerous; some of them are entirely harmless even if introduced into the human body. Others are the bacteria of decomposition, or putrefaction, which are known as "saprophytic" bacteria. All of the harmless ones are known as "non-pathogenic,"—that is, non-producers of disease. Those which produce disease are known as "pathogenic"; and those which produce suppuration as "pyogenic" or pus-producing bacteria.

All of these bacteria are plants, and not, as is very frequently supposed, animals of a low form. The danger from their introduction into the body can be best appreciated, perhaps, by the statement of Belfield, who estimated that a single bacterium which weighs, approximately, only the $\frac{1}{40,000,000}$ part of a grain, if given plenty of food and plenty of "elbow room," would so rapidly develop that in three days it would form a mass weighing 800 tons! It is the old story of the blacksmith who was to get a penny for the first nail, two for the second, four for the third, and so on till a set of shoes would cost more than Crœsus could pay for.

The effect of the bacteria has been determined by experiment to be proportionate to the dose. A cubic centimetre is a cube two-fifths of an inch on each side. One-tenth of such a cube of pure culture of one bacterium (proteus vulgaris) contains 225,000,000 bacteria, and if injected under the skin of a rabbit will produce death. Less than 18,000,000 will produce no effect whatever. Of one kind of staphylococcus, if 250,000,000 are introduced under the skin of a rabbit there will be produced a small abscess, but it requires 1,000,000,000 to produce speedy death. On the other hand, of the bacillus of lockjaw it requires only 1000 to produce death, so virulent is this germ.

Moreover, their effect on tissues and persons in different conditions varies very much. Thus, it is found that when a certain number of bacteria are injected into the cavity of the abdomen of an animal, if the animal is healthy and the peritoneum (the thin lining membrane of the abdomen) is healthy, the animal will recover perfectly well; but if the peritoneum be scraped and torn (and it must be remembered that the healthy peritoneum is devoid of sensation), that the same dose which before was harmless will now produce a violent peritonitis and very likely death. The practical lesson from this experiment upon animals is very evident. Every surgeon who opens the abdomen is most careful, if possible, not to injure the peritoneum, but to manipulate with the greatest gentleness lest fatal results follow any serious injury to that membrane. So, too, it is found that an injection of bacteria from which a healthy animal would recover will be followed by fatal consequences if the general health is below par. Again, if an animal has a simple fracture of his thigh-bone, and that is the only injury that he receives, no infection from the exterior having occurred, he will make a good recovery; but if at the same time he receives a lacerated wound, it may be even in another part of the body, and his wound, not being cared for most scrupulously, becomes infected, the infection will fasten on the distant spot of least resistance, the broken thigh-bone, and will produce a most dangerous and very frequently fatal form of inflammation.

I need scarcely point out in this connection, as, in fact, throughout this entire consideration of bacteriology, how important a part in its development has been played by experiment upon animals. The experimental facts just stated are of vital importance in the treatment of surgical diseases, and evidently could not have been determined upon mankind. It is not too much to say that had vivisection been restricted or prohibited the surgery of to-day would be the barbarous surgery of thirty years ago.

Even granting that an enormous number of the bacteria are harmless, the wonder is that with so many foes on every hand we live an ordinary lifetime. Fortunately, however, in the human body there is not only a lack of sufficient food and enough "elbow room" for them to work their dire effects, but there is that which "makes for righteousness" in our physical organization as well as in our souls.

The moment that bacteria are introduced into the human body a certain number of cells hasten to destroy them. These are called "phagocytes" or devouring cells, because they eat up the bacteria. Whether the patient survives or dies depends on whether the bacteria get the upper hand of the phagocytes or the phagocytes the upper hand of the bacteria.

These statements are very easy to make, but the results have only been obtained by prolonged and laborious investigations in the laboratory and by experiments upon animals which have demonstrated these facts.

The bacteria are recognized by various methods: First, by form. Many which are identical in appearance, however, differ greatly in effects. A handful of turnip-seed and a handful of rape-seed look very much alike, but if they are planted the plants differ so greatly that we can recognize the difference in the seed by the difference in the crop; hence the second method of recognizing differences in bacteria is by planting them. Different methods have been practised. Some are sown on the raw surface of a potato; others on bread paste; others in certain jelly-like materials, such as gelatin or agar-agar. It was soon found as a result of these experiments that the bacteria flourished best, some in one soil, some in another. Again, the crops of mould which come from them differ greatly in color, some being black, some red, some white, some yellow, etc. A third method also is by staining them with various dyes, when it is found that some bacteria will take one stain best, others will take another, and so on through the whole list.

At first it was thought that these bacteria existed chiefly in the air, and hence in Lister's early methods powerful spray-producing apparatuses were used; but, while it is true that they do exist in the air, it is found that this is not the principal source of infection. There is no substance (which has not been disinfected) that is not covered with the germs of these little plants. They exist in our food and drink; but the intestine is, one may say, a natural home in which many exist without harm to the body.

From a surgical point of view their existence is most important, first in the earth, where, as I have already shown, the bacillus of lockjaw is most frequently found. So, too, the bacillus of wool-sorters' disease (anthrax) exists in the earth. If an animal dying of anthrax is buried, worms coming from the carcass up through the ground carry the infection so that other animals grazing over this surface will readily become infected. The means by which we can avoid infection from the earth is very evident,—viz., that every person who has been run over by the cars or who has fallen on the ground and broken his leg, etc., must have the wound most carefully cleansed from all dirt. If this is scrupulously done the danger of tetanus or other similar earth-born bacterial disease is almost nothing.

A still greater danger to every patient, however, is found in the clothing, in the skin, and all dressings which are applied to wounds. The skin is full of bacteria of the most dangerous kind; even the spotless hands of the bride are, in the eyes of the surgeon, dirty. No one can touch a wound with ordinarily clean hands without infecting it. All clothing, dressings, —e. g., lint and soft linen rags,—and such like are full of bacteria of the most dangerous kind. Perhaps the most dangerous place is the space under the nails of the surgeon's hand, for the mere mechanical removal of any dirt under the nails by cleansing them does not make them clean surgically. The nails must be cut short and prepared in a way I shall mention directly or they are full of peril to any patient into whose wound a non-disinfected finger is introduced. Again, another source of infection which thirty years ago we never thought of is our instruments. Then, instruments were washed with soap and water and were made clean to the eye; but they were covered with death-dealing bacteria which especially hid in the joints and irregularities of the surface of all instruments.

All of these somewhat detailed statements lead up to a consideration of the difference between the old surgery and the new. Thirty years ago when an operation was to be performed or an accident cared for we laid out our instruments, which were visibly clean, used them with hands which were as clean as those of any gentleman, and applied soft linen rags, lint, and other dressings. To-day we know that these apparently clean instruments, hands, and dressings are covered with bacteria which produce infection and, therefore, suppuration, and frequently run riot in blood-poisoning, erysipelas, lockjaw, and death.

How does a modern surgeon perform an operation? All bacteria can be killed by heat. Cold has no effect upon them, but the temperature of boiling water (212° F.) is sufficient to destroy them all, usually within fifteen or twenty minutes; hence, first, instruments are all boiled, and, secondly, dressings are either steeped in such solutions as have been found to destroy the bacteria, such as carbolic acid or corrosive sublimate, or other preparations, or, still better, are placed in sterilizers, that is to say, metal cylinders, which are then filled with steam, usually under pressure, so as to obtain a temperature of 240° F., and thus make sure of the death of the bacteria. Unfortunately our hands cannot be boiled or steamed, but the modern surgeon first uses soap and water most vigorously over his hands and arms beyond the elbows. The nails are cut short and the scrubbing brush is especially applied to the nails so as to clean the fingers at their ends. Then by various means, such as pure alcohol, which is one of our best disinfectants, or solutions of corrosive sublimate, and other means too technical to mention, the hands are sterilized. Rubber gloves are frequently used, so as to preclude infection, as they can be steamed to 240° F. Removing at least his outer clothing, the surgeon puts on a cotton gown which has been steamed and so made free from bacteria. Not a few surgeons also wear sterilized caps, so that any bacteria in the hair will not be sifted into a wound, and some wear respirators of sterile gauze over the mouth and beard for a similar reason. All the dressings have been sterilized by superheated steam. All the threads by which blood-vessels are tied have been either boiled or otherwise sterilized. All the material for sewing up the wounds and the needles with which they are sewn up have been similarly disinfected. The skin of the patient is also sterilized, usually the day beforehand, in the same manner in which the surgeon's hands have been disinfected and are disinfected a second time just at the moment of the operation. If the case is one of accident, such as a crushed leg from a trolley car, all of the dirt is most carefully washed away with soap and water and the parts are disinfected, not only on the exterior, but also by prolonged washing with some cleansing agent in the interior of the wound, the patient being under the influence of ether, of course.

It is easily seen from such a description of a modern operation that no case can receive due care in one of our modern homes, even the best. The facilities do not exist, and hence surgeons are more and more declining to do operations, whether for accident or disease, in private houses, except in cases of absolute necessity, and a happy custom is growing more and more in favor with the community of having all operations done and all accidents cared for in a well-equipped modern hospital.

XII. Results of Modern Surgery.

As the result of our ability to perform operations without pain, thanks to anæsthesia, and our ability to perform operations without infection, and, therefore, almost without danger, thanks to antisepsis, the range of modern surgery has been enormously increased. Unless one has lived through the old surgery and into the new he scarcely can appreciate this widening of the field of operative surgery. Thirty years ago, in consequence of the great danger of opening the head, the chest, or the abdomen, or, in fact, of making an incision anywhere about the body, the surgeon never dared to interfere until he was obliged to do so. Hence, not only were many modern operations not even thought of, but in obscure cases we had to wait until time and disease developed symptoms and physical signs such that we were sure of our diagnosis and then, knowing that death would follow if we did not interfere, we ventured to operate. Now we anticipate such a fatal termination, and in most cases can avert it.

In perhaps no class of cases has the benefit of this immunity from infection and danger been shown than in the obscure diseases of the brain and the abdomen. To-day if we are uncertain as to whether there is serious danger going on which if unchecked will result in death, we deliberately open the one cavity or the other in order to find out the exact state of affairs. Supposing that the mischief is trifling or even that there is no mischief, we then know how to deal with the symptoms which have been puzzling us. So far as the exploratory operation is concerned, the patient recovers from it in a short time, and, meantime, perhaps, has also been cured of the symptoms which were before so ill understood. If any serious disease is found, in the majority of cases we can cope with it successfully. Before the days of antisepsis and anæsthesia the field of operation was greatly restricted, and practically the removal of tumors, amputations, and a few other operations were all that were done. Now all the then inaccessible organs are attacked with an intrepidity born of an assurance of safety. Recovery usually sets the seal of approval on the judgment of the surgeon. Thirty years ago, taking all operations together, fully one-third of our patients died, many of them often from slight operations which were followed by infection. To-day, including even the far more grave operations which are now done, the general mortality will scarcely exceed five per cent., and many surgeons are able in a series of several hunderd operations to save ninety-seven out of every hundred patients.

XIII. Serum Treatment.

Another remarkable recent discovery, the result of numerous and careful investigations in the laboratory, is a wholly new means of treatment,—viz., that method which is known as orrhotherapy or serum-therapy, or the treatment by injecting certain antitoxines under the skin by a hypodermatic syringe. It would lead me too far to enter into the theory upon which these were first used. Suffice it to say that in the blood of an animal that has passed through a certain disorder the liquid part contains an antidote or antitoxine. If a certain amount of this is injected under the skin of an animal or man suffering from the same disorder in its incipient stages the antitoxine prevents the development of the disease. The use of this method has thus far been much more medical than surgical and its results in diphtheria and other medical disorders have been perfectly marvellous. In surgery, however, less favorable results have been obtained, but in all probability in the future we shall be able to do for some of our surgical disorders what the physician can do to-day for diphtheria.*

There has been also discovered another means which in surgery has rendered some valuable service. From certain organs, as, for instance, the thyroid gland (the gland whose enlargement produces goitre), we can obtain a very potent extract of great value. In cases of goitre very noteworthy

* For the remarkable results in diphtheria I must refer the reader to Professor Osler's paper in this same series of papers.

results have already been obtained by the administration of this thyroid extract. A number of other organs in the body of animals have been used to combat certain disorders in the human body with advantage. The chief development of both of these new forms of medication, however, will take place in the twentieth century.

XIV. Instruments of Precision.

Another direction in which the century has seen enormous progress is in the introduction of instruments of precision. When I was a student in the early sixties instruction in microscopy was conspicuous only by its absence from our medical curriculum. Now, every student who graduates is more or less of an accomplished microscopist and carries into his practice the methods and observations which the microscope furnishes him. At the same period I remember being greatly interested in a discussion which two of my teachers had as to whether it was possible to make an application accurately to the vocal chords in the larynx. Now every tyro in medicine makes such applications to the larynx as a routine procedure in cases requiring it, and similar methods have been applied by the ophthalmoscope to examine the interior of the eye; the rhinoscope, to examine the interior of the nose; the otoscope, for examination of the ear, and other similar instruments for examining all the other hollow organs in the body. If I add to these the hypodermatic syringe, the aspirator, which may be described as a large hypodermatic syringe for suction instead of injection; the clinical thermometer, which was introduced in the late sixties; the hæmostatic forceps, for controlling hæmorrhage by seizing the blood-vessels and clamping them till we have time to tie them, and other instruments intended to facilitate our operative methods, it will be seen at once that the armamentarium of the modern surgeon is very different from that of his predecessor at the beginning, or even at the middle, of the century.

XV. The Roentgen Ray.

One of those extraordinary discoveries which startle the whole world was made nearly at the end of the present century, in the winter of 1895–96. At that time a modest professor in the University of Würzburg, announced that he could readily see the skeleton inside the body through the flesh. Naturally, the first announcement was received with almost absolute incredulity, but very soon his discovery was confirmed from all sides and it has now taken its place among the recognized facts of science. By means of certain rays, which, being of unknown nature, were called "X" rays, after the well-known mathematical *x*, or unknown quantity, Professor Roentgen has shown us that not only can the bones be seen, but that almost all the organs in the body can be seen and their form and structure reproduced in pictures. The reason they can be seen is because they are all obstacles to the passage of these *x*-rays and so produce shadows on a sensitized photographic plate.

If the exposure is sufficiently prolonged the rays penetrate even through the bones and act upon the photographic plate, so that no shadow remains. If the rays are allowed to penetrate for a shorter time the bones show dense shadows and one can get a light shadow of the soft parts. If the exposure is still shorter, then we can recognize the dense shadow of the bone, the much less dense shadows of the muscles, and the still lighter shadows of the layer of fat immediately under the skin. The heart can be seen beating and its shadow is now a well-recognized feature in skiagraphs of the chest. At first it was thought impossible to discover anything inside of the bony skull, but there are now on record nearly a score of instances in which bullets have been detected within the skull, and after trephining have been found and removed exactly at the location indicated. It is a very common thing now to locate a piece of steel or other similar foreign bodies within the eyeball by the method of Dr. Sweet, or some similar method within one or two millimetres (a millimetre is one twenty-fifth of an inch). It is now well recognized that even stones in the kidney will throw shadows sufficiently strong for them to be recognized, and, by noting their level in relation to the vertebræ, we can tell precisely in what part of the kidney to make the incision in order to find and remove them. It has happened to myself and many other surgeons to cut down upon a kidney, believing that there was a stone in the kidney, only to find that we had been misled by the apparently clear symptoms of such a foreign body. In future no such mistakes should be made by any surgeon within reach of a skillful skiagrapher. Unfortunately, gall-stones* and numerous other foreign bodies, vegetable substances, such as beans, corn, wood, etc., being as transparent to the x-rays as are the soft parts, are not revealed by means of this new method of investigation; but cavities in the lung, abscesses in bone, and similar diseases which produce thinning of the lung, bone, and other such organs, and so lighten instead of deepen the shadows, can now be recognized by means of light spots in the pictures as well as others by means of a shadow.

I spoke a moment ago of the need of a skillful skiagrapher, for it must be remembered that there may be the same difference in the personal skill and, therefore, in the reliability of the results, in skiagraphy as there is in photography. A poor photographer will get results very different from a skillful one, even if he uses precisely the same quality of plates and precisely the same camera. Personal skill and experience in the skiagrapher is, therefore, one of the most important elements in success. It must be remembered, also, that the

* Of course, happily, this is no longer true.—(W. W. K., 1905.)

x-rays in not a few cases may mislead us. I have personally fractured a bone on account of deformity, and taken the x-ray picture immediately after the operation, and yet the picture showed not the slightest evidence of a fracture which I absolutely knew existed. Moreover, foreign bodies found on the outside of the person may mislead us, as, for example, the metal part of suspenders, a coin in one's pocket, and such like. They look in the picture as if they were inside rather than outside the body, and any article the shape or size of which would not reveal its nature might easily be mistaken for a foreign body within the patient. Therefore, in many cases only an expert can determine precisely what the skiagraph means. I especially mention this, because there is a tendency at present to utilize skiagraphs in court in order to convince the jury that such a picture is an evidence of malpractice. Such pictures always need an interpreter in order to judge correctly of their meaning. It is precisely as if the jury were asked to look through a microscope. I have been myself accustomed to use the microscope for thirty years, but there are many instances even yet in which I am obliged to ask a pathologist or bacteriologist what I really am looking at in the microscope. While one may make a mistake of small moment in some cases, yet if a man's life or liberty or purse is at the mercy of a jury which does not know how to interpret a skiagraph and may, therefore, give a verdict which is "precisely wrong," as Professor Lincoln, my old teacher of Latin, used to call many of our translations, it will be a very serious matter and lead to gross injustice.

XVI. City and Village Hospitals.

Another great improvement in our means of caring for our surgical patients is the establishment of hospitals all over the land. These, happily, are not limited to our great cities, but in every country town and not a few large villages, small, but well-equipped and well-managed, hospitals have been established and have done incalculable good. It is not too much to say that every city or town establishing such a hospital is repaid a hundredfold.

XVII. Trained Nurses.

The trained nurse has, fortunately, come to stay. In fact, our antiseptic methods as above described have made the trained nurse indispensable. The old nurse who by many clumsy experiments on her patients had obtained a certain rule-of-thumb knowledge of the care of the sick can no longer assist in a surgical operation or properly care for any surgical patient. The modern nurse must of necessity be a well-educated, well-trained woman knowing thoroughly modern antiseptic methods and on the alert to observe every symptom of improvement and every signal of danger.

Without a well-trained nurse it is impossible at the present day properly to care for any serious surgical case, and I gladly bear witness to the intelligence, fidelity, and skill of scores of nurses who have assisted me, without whom I should have felt as one blade of a scissors without its fellow.

XVIII. Special Operations.

(a) *Amputations and Compound Fractures.*—Having now traced the different modes of thought which have aided surgical progress in the present century and the different means of investigation, let us turn finally to the progress in individual operations. As to amputations and compound fractures, I have already indicated the immense improvements which have followed the introduction of anæsthesia and especially of antisepsis, which have brought the mortality of amputations down from 50 or 60 per cent. to 10 or 15 per cent., and in compound fractures, once so dreaded, since the mortality was not infrequently as high as 2 out of 3 to a relatively insignificant danger.

(b) *Tumors.*—In no department, perhaps, has the introduction of antisepsis and the use of catgut and silk ligatures after the antiseptic method brought about a greater improvement than in operations for tumors. The startling reluctance of Sir Astley Cooper to operate on King George IV, for so simple and small a tumor as a wen, lest erysipelas might follow and even destroy his life—a very common danger 100 years ago—is in marked contrast with the success and, therefore the boldness, of modern surgeons. Tumors in all parts of the body, whether they be external or internal, whether they involve the wall of the chest or are inside the abdomen, are now dealt with with almost perfect safety. Anæsthesia has made it possible to dissect out tumors in so dangerous a region as the neck, where the surgeon is confronted with adhesions to the jugular vein, the carotid artery, and the nerves of the neck and of the arm, with the greatest impunity. Such an operation not uncommonly lasts from three-fourths of an hour to an hour and a half, and involves often the removal of two or three inches of the jugular vein and many of the large nerves, the removal of which a few years ago would have been deemed an impossibility.

(c) *Goitre.*—One of the most striking instances of progress is operations on goitre. Writing in 1876, the late Prof. Samuel D. Gross noted it as something remarkable that Dr. Green, of Portland, Me., had removed 7 goitres with 2 deaths, and the late Dr. Maury, of Philadelphia, had extirpated 2 goitres with 1 death. In marked contrast to this Professor Kocher, of Berne, in 1895 reported 1000 cases, of which 870 were non-cancerous, and he lost of these last but 11 cases, or a little over 1 per cent. In 1898 he reported 600 additional cases, with only 1 death in the 556 non-cancerous cases, or a mortality of only 0.1 per cent. It will be seen, therefore, that an operation which a few years ago was excessively fatal has become, one might say, almost perfectly safe.

(d) *Surgery of the Bones.*—Operations on bones apart from amputations show also a similar improvement. In cases of deformity following fracture we now do not hesitate to cut down upon the bone and refracture it or remove the deformed portion, join the ends together, dress the part in plaster of Paris to secure fixation, and have the patient recover with little or no fever and no suppuration. Above the elbow a large nerve runs in a furrow in the arm bone, and in case of fracture this is liable to be torn and a portion of it destroyed. The result of it is paralysis of all the muscles on the back of the forearm from the elbow down, and consequent inability to extend either wrist or fingers, making the hand almost useless. In a number of cases the nerve has been sought for and found, but the ends have been too far apart to sew them together. In such cases we do not hesitate now, in order to bring the two ends of the nerve together, to remove one or two inches of the arm bone, wire together the two ends of the shortened bone, sew the now approximated ends of the nerve together, put the arm in plaster, and as soon as the wound is healed, with appropriate later treatment to the muscles, we can obtain in a reasonable number of cases a perfect, or almost perfect, union of the nerves and a re-establishment of the usefulness of the hand.

In very many cases the bones are deformed as a result of rickets and in some cases in consequence of hip-joint disease. In such cases the leg is crooked or flexed and cannot be used for walking. Such cases of stiff joints and crooked legs are now operated on, one might say, wholesale. At the International Medical Congress, held in Copenhagen in 1884, Professor Macewen, of Glasgow, reported 1800 operations on 1267 limbs in 704 patients in which he had sawn or chiselled through the bones so as to fracture them, placed them in a straight position, and after a few weeks the bone has become consolidated and the leg or arm made straight. The whole number of operations was successful excepting five cases, and even these deaths were not due to the operation, but to some other disorder, such as an unexpected attack of pneumonia, diphtheria, or scarlet fever.

(e) *Surgery of the Head and Brain.*—In the surgery of the head we find one of the most remarkable illustrations of the modern progress of surgery. Fractures of the skull have been the most dangerous and fatal of accidents until within a short time. Of course, many of them even now must necessarily be fatal from the widespread injury to the bones and the brain. But our modern methods by which we can disinfect the cavities of the ear, the nose, and the mouth, with which these fractures often communicate and through these avenues become infected, are so successful that such cases, instead of being looked upon as hopeless, are in a majority of instances followed by recovery. Even gunshot wounds in which the ball may remain inside the cavity of the head are successfully dealt with, unless the injury produced by the ball has been necessarily fatal from the start. Fluhrer, of New York, has reported a very remarkable case of gunshot wound in which the ball entered at the forehead, traversed the entire brain, was deflected at the back of the skull, and then pursued its course further downward in the brain. By trephining the skull at the back of the head he found the ball, passed a rubber drainage tube through the entire brain from front to back and had the satisfaction of seeing the patient recover.

Until 1884 it was excessively difficult to locate with any degree of accuracy a tumor within the brain, but in that year Dr. Bennett, of London, for the first time accurately located a tumor within the skull without there being the slightest evidence on the exterior of its existence, much less of its location. Mr. Godlee (surgeons in England are not called "Dr.," but "Mr.") trephined the skull at the point indicated, found the tumor, and removed it. True, this patient died, but the possibility of accurately locating a tumor of the brain, reaching it, and removing it was now demonstrated, which is far more important to humanity at large than whether this individual patient survived or not. Since then there has been a very large number of tumors successfully removed. The latest statistics are those of von Bergmann, of Berlin, in 1898. He collected 273 operations for brain tumors, of which 169 (61.9 per cent.) recovered and 134 (38.1 per cent.) died. This is by far the best percentage of results so far reported, but there is reason to believe that with the constant improvement in our ability to locate such tumors and in our methods of removing them the mortality rate will be still further lessened.

Even more successful than the surgery of brain tumors has been that of abscesses of the brain. I have no available statistics of the exact numbers, but it is certain that several hundred have been operated on and with even better success than in the case of brain tumors. The most frequent cause for such abscesses is old and neglected disease of the ear. No child suffering from a "running from the ear," which is especially apt to follow scarlet fever and other similar disorders, should be allowed to pass from under the most skilled treatment until a cure is effected. This is the commonest cause of abscess of the brain. The inflammation in the ear which begins in the soft lining of the cavities of the ear finally extends to the bone, and after years of intermittent discharge will suddenly develop an abscess of the brain, which, if not relieved, will certainly be fatal. Prompt surgical interference alone can save life, and, happily, though we cannot promise recovery in all, a very large percentage of success is assured.

In epilepsy as a result of injuries of the head, in a moderate number of cases we can obtain a cure of the disease by operation, but in the great majority of cases, and, one may say, practically in all of the cases in which the epilepsy originates "of itself,"—that is to say, without any known cause,—it is useless to operate, certainly at least after the epileptic habit has been formed. Possibly were operation done at the very beginning we might obtain better results than experience thus far has shown us is possible.

Very many cases of idiocy are constantly brought to surgeons in the hope that something can be done for these lamentable children. Unfortunately, at present surgery holds out but little hope in such cases. In a few exceptional instances it may be best to operate, but a prudent surgeon will decline to do any operation in the vast majority of cases.

(f) *Surgery of the Chest and Heart.*—The chest is the region of the body which has shown the least progress of all, and yet even here the progress is very marked. When, as a result of pleurisy, fluid accumulates on one side of the chest, even displacing the heart, we now do not hesitate to remove an inch or two of one or more ribs and thoroughly drain the cavity with not only a reasonable, but in a majority of cases, one may almost say, a certain prospect of cure. We have also entered upon the road which will lead us in time to a secure surgery of the lung itself. A few cases of abscess, of serious gunshot wound attended by otherwise fatal hæmorrhage, and even of tuberculous cavities in the lungs have been successfully dealt with, but the next century will see, I have no doubt, brilliant results in thoracic surgery.

One of the most striking injuries of the chest has recently assumed a new importance,—viz., wounds of the heart itself. In several instances an opening has been made in the bony and muscular walls of the chest and a wound of the heart itself has been sewed up. The number is as yet small, but there have been several recoveries, which lead us to believe that here, too, the limits of surgery have by no means been reached.*

(g) *Surgery of the Abdomen.*—Of the abdomen and the pelvis

*Stewart (Amer. Jour. Med. Sci., Sept., 1904, p. 431) has collected 60 cases with 23 recoveries.—(W. W. K., 1905.)

a very different story can be told. These cavities might almost be called the playground of the surgeon, and the remarkable results which have been obtained warrant us in believing that even greater results are in store for us in the future.

In the earlier part of this article I spoke of the advantages of the study of the pathological anatomy of the diseased condition of individual organs. Perhaps no better illustration of the value of this can be given than in the study of appendicitis. This operation has been one of the contributions to the surgery of the world in which America has been foremost. While there were one or two earlier papers, Willard Parker, of New York, in 1867 first made the profession listen to him when he urged that abscesses appearing above the right groin should be operated on and the patient's life saved. But it was not until Fitz, of Boston, in 1886, published his paper, in which he pointed out, as a result of a study of a series of postmortem examinations of persons dying from such an abscess above the right groin, that the appendix was the seat of the trouble that this so frequent disease was rightly understood and rightly treated. As a result of the facts gathered in his paper, the treatment was perfectly clear, not only that we ought to operate in cases of abscess, but that, in the case of patients suffering from two or more attacks and often from even one attack of appendicitis, the appendix should be removed to prevent such abscess.

The mortality in cases in which such an abscess has formed is, perhaps, quite 20 or 25 per cent., whereas, if patients are operated on "in the interval,"—that is to say, when the abdominal cavity is free from pus,—the mortality is scarcely more than 2 or 3 per cent., and may be even less.

Surgeons are often asked whether appendicitis is not a fad and whether our grandfathers ever had appendicitis, etc. As a matter of fact, in my early professional days appendicitis was well known. It was called "localized peritonitis," or "localized abscess," but while the disease was very frequent, its relation to the appendix was not recognized until, from his study of its pathology, an American (Fitz) pointed it out. Even now European surgeons, with a few exceptions, are not alive to the need for operation in such cases.

There is little doubt that the great prevalence of grippe during the last few years has increased the number of cases of appendicitis, both of them being catarrhal conditions of the lining membrane of the same continuous tract of the lungs, the mouth, the stomach, and the intestines.

One of the most fatal accidents that can befall a patient is to have an ulcer of the stomach perforate so that the contents of the stomach escape into the general abdominal cavity. Until 1885 no one ventured to operate in such a case. In an inaugural dissertation by Tinker, of Philadelphia, 232 cases of such perforating ulcers of the stomach have been collected, of which 123 recovered, a mortality of 48.81 per cent. In not a few of them, if prompt instead of late surgical help had been invoked, even a still better result would have been reported. If no operation had been done the mortality would have been 100 per cent.

In cancer of the stomach itself we are able, as a rule, to make a positive diagnosis only when a perceptible tumor is found. By that time so many adhesions have formed and the infection has involved the neighboring glands to such an extent that it is impossible to remove the tumor, but the statistics even here are not without encouragement, at least for comfort if not for life. In many cases the tumor has been removed and the stomach and intestine joined together by various devices, and the mortality, which at first was necessarily great, has been reduced by Czerny to 12 per cent. and by Carle to 7 per cent. Even the entire stomach has been removed in several cases and recovery has followed in about one half. Most of these patients, however, have died from a return of the disease.

When, as a result of swallowing caustic lye or other similar substances, the gullet (the œsophagus) becomes contracted to such an extent that no food can be swallowed, we now establish an opening into the stomach through which a tube is inserted at mealtime and the patient has his breakfast, dinner, and supper poured into his stomach through the tube. If the stricture of the œsophagus is from malignant disease, of course this only prolongs life by preventing a horrible death by starvation, but in cases in which it is non-malignant life is indefinitely prolonged. The mortality of such an operation is very small.

By a freak of nature or disease the stomach sometimes is narrowed in the middle, forming what is called an "hour-glass stomach." In such a case we open the abdomen, make an opening into the two parts of the stomach, and unite the edges of the two openings so that we re-establish the single cavity of the stomach. The mortality of the operation is very slight,—8 per cent. Again, sometimes the stomach becomes unduly dilated, thus interfering seriously with its function. A number of surgeons in such cases have simply folded over the wall of the stomach upon itself and have sewed it together, taking a plait or "tuck" in the stomach wall, and have restored it to its normal capacity and function.

One of the most important advances has been made in the treatment of gall-stones. The bile in the gall-bladder is in a state of quiescence which is favorable to a deposit of crystals from the bile.* These crystals become agglutinated together into larger or smaller solid masses called gall-stones. Sometimes the number of these is very small, from one to four or five; sometimes they accumulate in enormous numbers, several hundred having been reported in a number of instances. Where they are small they can escape through the duct of

*Since this paper was written we have learned that the chief cause of gall-stones is infection from bacteria which act as nuclei around which the gall-stones form.—(W. W. K., 1905.)

the gall-bladder into the bowel and create no disturbance, but where they are large, so that they cannot make their escape, they not uncommonly are causes not only of serious discomfort and prolonged ill health, but often of death. Nowadays one of the safest operations of surgery is to open the abdomen and the gall-bladder and remove this menace to life, and the great majority of such patients recover without any untoward symptoms. Even large abscesses of the liver and, what is still more extraordinary, large tumors of the liver, are now removed successfully. A year ago all of the reported cases were collected which had been operated from 1888 to 1898, 76 in number. The termination in 2 cases were unknown, but of the other 74, 63 recovered and 11 died, a mortality of only 14.9 per cent.

The surgery of the intestines by itself is a subject which could well occupy the entire space allowed to this article. I can only in a very superficial way outline what has been done. Hernia, or rupture, is a condition in which through an opening in the abdominal wall a loop of the bowel escapes. If it could be replaced and kept within the abdomen by a suitable truss, this was the best that we could do till within the last ten or fifteen years. The safety and the painlessness of modern surgery which have resulted from the introduction of anæsthesia and antisepsis are such that now no person suffering from such a hernia, unless for some special personal reason, should be allowed to rely upon a truss, which is always a more or less treacherous means of retaining the hernia. We operate on all such cases now with impunity. Coley has recently reported a series of 639 cases, all of which recovered with the exception of 1 patient. Even in children, if a truss worn for a reasonable time, a year or so, does not cure the rupture, operation affords an admirable prospect of cure.

Every now and then a band forms inside the abdomen, stretching like a string from one place to another. If a loop of bowel slips under such a band, it can be easily understood that total arrest of the intestinal contents ensues, a condition incompatible with life. There are other causes for such "intestinal obstruction," which are too technical to be described in detail, but this may be taken as a type of all. It is impossible, of course, to tell before opening the abdomen precisely the cause of the obstruction, but the fact is readily determined in most cases. If we open the abdomen promptly we can cut such a band or remove the other causes of obstruction in the majority of cases, and if the operation has not been too long delayed the prospect of entire recovery is good. The mortality which has followed such operations has been considerable, and by that I mean, say, over 20 per cent.; but a very large number of the fatal cases have been lost because the operation has been delayed. In fact, it may be stated very positively that the mere opening of the abdomen to find out precisely the nature of any disease or injury is attended with but little danger. If further surgical interference is required the danger will be increased proportionately to the extent and gravity of such interference. But "exploratory operations," as we call them, are now undertaken constantly with almost uniform success.

Even in cancer of the bowel we can prolong life if we cannot save it. Cancer of the bowel sooner or later produces "obstruction" and so destroys life; but in such cases we can either make a permanent opening in the bowel above the cancer and so relieve the constant pain and distress which are caused by the obstruction, or in a great many cases we make two openings in the bowel one above the cancer and another below it and by uniting the two openings, if I may so express it, "side-track" the contents of the bowel. If the cancer has no adhesions and the patient's condition allows of it we can cut out the entire portion of the bowel containing the cancer, unite the two ends, and thus re-establish the continuity of the intestinal canal. As much as eight feet, nearly one-third of the entire length of the bowel, have been removed by Shepherd, of Montreal, and yet the patient recovered and lived a healthy life.

Similarly in gunshot wounds, stab wounds, etc., involving the intestine the modern surgeon does not simply stand by with folded hands and give opium or morphine to make the patient's last few hours or days relatively comfortable, but he opens the abdomen, finds the various perforations, closes them, and recovery has followed even in cases in which as many as seventeen wounds of the intestine have been produced by a gunshot wound.

The kidney, until thirty years ago, was deemed almost beyond our reach, but now entire volumes have been written on the surgery of the kidney and it is, one might say, a frequent occurrence to see the kidney exposed, sewed fast if it is loose, opened to remove a stone in its interior, drained if there be an abscess, or if it be hopelessly diseased it is removed in its entirety. The other kidney, if not diseased, becomes equal to the work of both.

Of the pelvic organs, it would not be becoming to speak in detail, but one operation I can scarcely omit; namely, ovariotomy. One of my old teachers was Washington L. Atlee, who, with his brother, was among the first ovariotomists in this country who placed the operation on a firm foundation. I heard a very distinguished physician in 1862, in a lecture to his medical class, denounce such men as "murderers"; but to-day how differently does the entire profession look upon the operation! Instead of condemning the surgeon because he did remove such a tumor, the profession would condemn him because he did not remove it. The operation had its rise in America. Ephraim McDowell, of Kentucky, in 1809 first did the operation which now reflects so much credit upon modern surgery. The mortality of the Atlees was about 1 in 3. Now, owing to the immense improvement introduced by the antiseptic methods, the deaths in competent hands are not over 5 per cent. or even 3 per cent.

The limits of this article compel me to stop with the story very imperfectly told, but yet, perhaps, it has been sufficient in detail to show somewhat of the astonishing progress of surgery within the century, but especially within the last quarter of the century.

About two decades ago one of the foremost surgeons of London, Mr. Erichsen, said in a public address that "surgery had reached its limits." How short was his vision is shown by the fact that surgery at that very time was just at the beginning of its most brilliant modern chapter.

We have reached in many respects, apparently, the limits of our success, but just as anæsthesia and antisepsis and the Roentgen rays have opened new fields to us wholly unsuspected until they were proclaimed, so I have no doubt that the twentieth century will see means and methods devised which will put to shame the surgery of to-day as much as the surgery of to-day puts to shame that of thirty years ago, and still more of a century ago. The methods by which this will be attained will be by the more thorough and systematic study of disease and injury, so as to better our means of diagnosis, and so prepare us for immediate surgical interference, instead of delaying it, as we now do in many cases for want of certain knowledge; by the use of new chemical and pharmaceutical means to perfect our antisepsis and possibly to introduce other methods of treatment; but above all, we shall obtain progress by the exact experimental methods of the laboratory. We can never make progress except by trying new methods. New methods must be tried either on man or on animals, and as the former is not allowable, the only way remaining to us is to test all new methods, drugs, and applications first upon animals. He who restricts and, still more, he who would abolish our present experiments upon animals is, in my opinion, the worst foe to the human race, and to animals as well, for they, as well as human beings, obtain the benefit derived from the methods. He may prate of his humanity, but he is the most cruel man alive.

THE MISSION OF A MEDICAL COLLEGE.*

TWELVE years ago I had the honor of delivering the introductory address at the opening of the session of the Jefferson Medical College. I took as my topic "The New Era in Medicine, and its Demands upon the Profession and the College." In it I pointed out the demands which this new era in medicine made on our medical colleges. To-day I purpose supplementing that address by considering an allied topic, "The Mission of a Medical College."

A mission is defined as "that with which a messenger or agent is charged," and I find in Webster an apt illustrative quotation from Milton:

> "How to begin, how to accomplish best,
> His end of being on earth and mission high."

There are missions for individuals, as for Columbus, Washington, and Lincoln, and in medicine for a Vesalius, a Jenner, and a Lister. There are missions for nations, as for the Hebrews in religion, the Greeks in art, the Romans in law, England and America in civil and religious liberty. But there are also missions for institutions, especially for institutions of learning, such as the Universities of Bologna, Oxford, Edinburgh, Harvard, etc. Has not the Medical College a mission? If so, what is its nature and how is it being accomplished? The mission of institutions of learning, among which may be classed the medical school, is

* Address delivered at the Seventy-sixth Commencement of the Jefferson Medical College of Philadelphia, May 15, 1901. Reprinted from American Medicine, May 25, 1901.

threefold: First and foremost the development of the character of its students; secondly, the education of its students; and, thirdly, the encouragement of original research.

First, the development of character; that is "the sum of the moral and mental qualities which distinguish an individual viewed as a homogeneous whole." The school which instructs the intellect, but does not develop the moral character of its students, fails in its most important duty. "Intellect alone is cold, heartless, and selfish; it must be lighted up by moral and spiritual principles to reveal its beauty or fulfill its high mission."

Character is partly the result of heredity and of environment. Those who are so fortunate as to possess parents to whom they can look up with reverence, even after they have passed away, are most happy. They have had a training which nothing else can replace. The environment which they have had at home and the subtle influences of the family life will influence their whole subsequent career. The preliminary education which they have had, the physical health with which they have been endowed, the mental stimulus that they have received from their parents, all these count for much. Then there are undoubtedly individual differences; for example, the slothful, the vicious, the brave, intelligent, hard-working, and virtuous. It would be a trite saying to assert that the last are those who will win the prizes in the struggle of life.

But when a young man has left his home and enters the medical school, he comes under a different set of influences, partly from his fellow-students, but chiefly from his teachers. He is moved by their example, observes their industry, acknowledges their ability, and recognizes their success in life as due to a sturdy character which in turn develops the character of the student. The College is a center for those projectile moral forces which, once set in action, prolong their effects for many years afterward in well-nigh every student.

We can point for example in this school to the splendid and forceful lives of a McClellan, a Dunglison, a Gross, a Pancoast, and a Da Costa, whose influence on the character of hundreds and even thousands of men all over the world tells for the best and the highest ideals in medicine.

Not the information which one acquires in a medical school or in any other educational institution is of the most value. The *methods* he learns rather than the *facts* which he acquires: the high ideals which are instilled into him rather than the low cravings for a mere sordid success—these are the things which are of value and develop most the character. To do one's level best every day with every patient and in many cases without hope of fee or reward save the sense of duty done, the inspiring influence of success in the constant and irrepressible conflict between good and evil, life and death,—this is what is of more value to the student of this and every other college than the mere information which he has acquired. It is not given to everyone to occupy a conspicuous place, but every one of you in your sphere, humble though it may be, can do your daily duty faithfully and truly, and if you do this, if you develop a high and noble character, even though your sphere be humble, when you lay down life's burdens the Great Master may well say to you, "Well done, good and faithful servant." Character depends not on the sphere, but on the person, not on the greatness of the opportunity, but on how the opportunity is met. Let me quote a portion of the justly-celebrated oath of Hippocrates to show you, away back in the fifth century before the Christian era, how well the Father of Medicine met his opportunity and set us an example we well may follow:

I will "reckon him who taught me this Art equally dear to me as my parents, to share my substance with him, and relieve his necessities if required; to look upon his offspring on the same footing as my own brothers, and to teach them this art, if they shall wish to learn it, without fee or stipulation; and that by precept, lecture, and every other mode of instruction, I will impart a knowledge of the Art to my own sons, and those of my teachers, and to disciples bound by a stipulation and oath according to the law of medicine, but to none others. I will follow that system of regimen which, according to my ability and judgment, I consider for the benefit of my patients, and abstain from whatever is deleterious and mischievous. I will give no deadly medicine to anyone if asked, nor suggest any such counsel. . . . With purity and with holiness I will pass my life and practise my Art. . . . Into whatever house I enter, I will go into them for the benefit of the sick, and will abstain from every voluntary act of mischief and corruption. . . . Whatever, in connection with my professional practice, or not in connection with it, I see or hear, in the life of men, which ought not to be spoken of abroad, I will not divulge, as reckoning that all such should be kept secret. While I continue to keep this oath unviolated, may it be granted to me to enjoy life and the practice of the Art, respected by all men in all times! But should I trespass and violate this oath, may the reverse be my lot!"

The second mission of a medical school is education. In the address already alluded to, I pointed out in considerable detail the enormous and rapid strides which had been made in medical education in the last thirty years. It is especially gratifying that the progress made has not been only in medicine proper, but largely in the preliminary education which is required of medical students of to-day. The better educated men you are at starting, the better educated men you will be at the finish, and, as a rule, the greater your success. But along with this better preliminary education in order to meet the enormously increased demands of a modern medical education, a college must furnish facilities which were not in existence thirty years ago, but are absolutely indispensable now. Let us see how the demand has been met:

The former methods were limited to lectures and text-books.

The spoken word, in my opinion, is of the greatest importance. Fresh from his everyday contact with disease and death, an impressive, ardent lecturer exerts a powerful influence which nothing else equals. His flaming words awaken enthusiasm and stamp his ideas on his students. But this alone is quite insufficient for your purpose. It must be supplemented by your text-books. In them is garnered the knowledge of the past and the present. This is indispensable as a starting point. As there were brave men before Agamemnon, so there were great surgeons before Gross. They were men with few of our artificial helps, but they had eyes and ears and fingers to observe with and common sense and sharp intellects to utilize their stores of accumulated facts.

But the knowledge of other men which one reads about is with difficulty made part and parcel of our own intellectual bone and muscle. We must do more than this. We must develop individual observation and individual, personal knowledge. This is done in the modern medical school in two ways relatively new.

The most striking change in modern medical education is the introduction of the laboratory. There the medical student has his powers of observation developed by his teachers in approved directions and trained and filed to a fineness by careful personal investigations. There he learns not what others have done, but what he himself can do and sees the results that he himself has accomplished. Yet, when I began the study of medicine in 1860, there was absolutely no laboratory connected with the Jefferson, or any other medical college, with the exception of the dissecting-room; that is, the laboratory of anatomy. Now we have eleven laboratories, through each of which every student passes, and there learns to observe for himself and think for himself. That was a very brief, but pregnant, reply of Huxley to a querulous correspondent, a reply which epitomizes the value of knowledge acquired for one's self by actual personal investigation. "Take a cockroach and dissect it."

The other relatively new method is the clinical; that is to say, each individual student is not taught, as formerly, only didactically the symptoms of disease which he must memorize, and the treatment which, very likely, he will forget, but in small ward classes he is made to examine as many patients as possible for himself, elicit the family and the personal history, institute a physical examination, percuss, auscultate, palpate, and by the most approved clinical methods discover the nature of the existing ailment, understand its pathology, comprehend its symptoms, and suggest the proper treatment, all by the exercise of his own brains. Contrasting the exclusively didactic methods when I was a student with those of to-day, which are so personal and individual, the difference is almost that of darkness and of light. Surely, the Jefferson Medical College, which has tripled the length of its course of instruction and quadrupled the means and the thoroughness of instruction, is fulfilling its mission.

Yet, any medical school which is content with its present methods of fulfilling its mission has at once fallen from its high estate. If it does not advance to newer methods, to better methods, to more exact methods, it is left behind in the march of progress. The whole history of the well-nigh fourscore years that the Jefferson Medical College has existed shows that it has constantly made progress to these better and better methods. That the next half-century will witness a still greater progress who can doubt?

The third mission of a medical college is to encourage original research. Teaching existing knowledge is very well and for the student is the chief end or final cause for which a medical college exists. But the medical school owes a duty to the profession, to the public, and to the cause of science. This duty is constantly to add to our present knowledge, to solve the riddles of disease, to answer the questions which are ever arising in the human mind as to our animal existence, with all its disorders and accidents and our mental capacity and its disturbances, and persistently and intelligently to improve our means and methods of treating these deviations from the normal. We must restlessly and continually enlarge the boundaries of knowledge if we desire to make progress—and where in the quest for additional knowledge should investigation and original research be so likely to find a congenial home as in the very institutions where the present state of knowledge is exhibited from day to day, where teacher and pupil, conscious alike of the limitations of their knowledge, long for a better and a wider view?

The characteristic of the past century, which Wallace has so well described as the "Wonderful Century," is that of original research and the consequent growth of every department of human knowledge. Witness the enormous progress in our means of transportation on land and water for social and commercial purposes; witness the wonderful development of our manufactures from the invention of the steam engine, the sewing machine, the cotton-gin; the various electrical devices, such as the telegraph, the telephone, the trolley car, and the dynamo; the fast printing press; the improved processes for making iron and steel; and a hundred other instances which occur to you in a moment.

All these, mark you well, are the result of the searching, persistent careful work of the scientific student in the laboratory. They are not accidents, they have followed in the wake of the discovery of the laws of dynamics, of electricity, of chemistry. First came that which was pure theory, then the practical application for the welfare of the world.

Nor has medicine lacked during this wonderful century. We have seen the introduction of vaccination, of anæsthetics, of antisepsis, which three, as with a besom, have swept into oblivion a large part of the disfigurements, pain, and death which ravaged the race in former centuries; of the serum treatment of disease, which has gone far to put an end to the hecatombs of victims of diphtheria and its congeners. Pharmacology has given us so many new drugs that our prescriptions differ as the antipodes from those of one hundred years ago. Bacteriology has revealed the actual causes of many diseases and, still better, has shown us how to protect mankind from their invasion. Chemistry has given us new and efficient methods of sanitation, which have wonderfully prolonged human life. The microscope has laid bare to us the processes of disease; the blood has yielded up at least some of its secrets; the examination of the secretions now warns of unsuspected dangers. We can see the spectral forms of the bones and even the beating of the heart by the *x*-rays, and instruments of precision have enabled us accurately to weigh and to measure, where before we only vaguely guessed.

In view of this enormous progress, it may be asked whether there is anything left to be discovered. To this it may be replied that, if, starting with their poor equipment, our sturdy fathers made such immense forward strides, shame upon us, their degenerate sons, if, with our rich inheritance, we cannot outdo them and solve many of the enticing problems by which disease beckons us onward into the realms of the unknown; if there are not among us other Jenners, and other Listers, and other Roentgens, to make the twentieth the most illustrious of the centuries!

What a boon will he confer upon humanity who discovers the cause and the means of cure of those curses of the race—cancer, sarcoma, and other tumors; of syphilis, typhus fever, rheumatism and gout, scarlet fever, measles, and even who can tell?—a panacea for old age and all its evils!

Other triumphs, too, in wholly unknown and unsuspected realms await the patient, persistent investigator. These triumphs will be won by close observation at the bedside and by indefatigable investigations in the laboratory. To me the most encouraging sign of the times in medicine is the enthusiasm with which the laboratory has been welcomed, not to replace, but to be the handmaid of, the clinician.

In this country our medical schools have not been wanting in their duty. I need but to point to the many laboratories now in actual daily use, not only facilitating the instruction of the student, but training up skilled assistants who, within the next few years, will be in the van in making new discoveries of the utmost importance to the well-being of mankind.

But all this means more buildings, enlarged equipment, more men, more money. Whence are all these to come? The student cannot pay increased fees at all commensurate with the increased expense of his education. The older methods, where one man lectured to 200, 400, or 500 men at once have been replaced by a method of instruction which requires the training of small classes of 20, 15, 10, or even one or 2 men by a single teacher. In other words, our modern methods have wholly changed from general instruction given to large classes, to individual instruction of smaller classes and often even of single students. As Harvard, Yale, Princeton, Brown, and all other universities are clamoring for increased endowments for just such enlarged work and are getting them, just so the medical school must have increased funds for providing facilities for instruction and research, and especially must have endowments by which these hitherto unknown expenses can be met.

I have indicated the mission of the medical school and have shown that it is being splendidly fulfilled. Is there no corresponding duty also for the community? Shall it be, can it be, that these ardent teachers and these faithful students shall valiantly struggle on in the endeavor to solve the problem how to transmute sickness into health, how to avert the dire effects of accident, how to say to death, "thus far and no farther," and the community stand aloof, apathetic and indifferent, absorbed in business, forgetful that sickness and sorrow must some time inevitably come to them? Remember that sickness and sorrow can only be averted by the highest skill, the greatest learning, the wisest judgment, all founded upon knowledge gained in these expensive laboratories and in these great hospitals which train the men who are to minister to you in the time of peril.

Citizens of Philadelphia, to you we must appeal. Yonder College and Hospital, as I have told you, are fulfilling their "mission high," but are sorely hampered for want of larger means. Every week we have to refuse worthy sufferers for want of a larger number of beds in a constantly crowded hospital. You can give them to us. We need endowments for Professorships, for Fellowships, and for Scholarships. You can give them to us. By your gifts and your bequests you may make possible the fine ideals which we hope to realize. We have the men, men of brains, of education, of industry, who are longing only for the opportunity. If you but knew as I know how earnest, how intense, how consuming is the longing in these very young men before you to do their level best, if you only give them the chance! Must we Americans, we Philadelphians, say them nay for want of such encouragement and of such gifts? I do not believe it. As in your hours of sickness you trust implicitly to us, so in your hours of health and wealth we trust implicitly to you, and I know we shall not trust in vain.

THE DUTIES AND RESPONSIBILITIES OF TRUSTEES OF PUBLIC MEDICAL INSTITUTIONS.*

THE value of occasional and stated gatherings of the principal leaders of medical thought in the various special departments is acknowledged by all. Certainly those who have attended this Congress, now held for the sixth time, have felt its broadening influence. We are apt to become narrow when we are devoted heart and soul to one specialty, be it medicine, surgery, physiology, ophthalmology, or any other. When we meet nearly all of the more prominent men in cognate interrelated branches of medicine in Washington every third year, we are sure to find that there are as interesting and as important questions in other specialties as there are in our own; and, moreover, we are sure to find that there are men of as acute intelligence, wide reading, and original thought in other than our own departments whom it is our pleasure to meet, and whose acquaintance becomes not only valuable for what we find them to be, but because of the stimulus that they give to our own thoughts.

Ordinarily the presidential address has been devoted to some special professional topic. My first idea was to select such a subject for to-night, but as I was absent from the country when I received the very highly appreciated notice of my selection, I asked the members of the executive com-

* The Presidential Address at the Sixth Congress of American Physicians and Surgeons, Washington, May 12, 1903. Reprinted from the Sixth Volume, Transactions of the Congress of American Physicians and Surgeons, 1903.

mittee for suggestions, being sure that their united judgment would be better than my own. I was very glad when they proposed the topic upon which I shall address you, partly because it is different from the usual type of such addresses, and partly because it seems to me appropriate to the present time. I shall, therefore, give the time at my disposal to presenting to you some thoughts on "The Duties and Responsibilities of Trustees of Public Medical Institutions."

Before entering upon my topic I beg to state explicitly that what I will say is offered in no spirit of unfriendly criticism, but only by way of friendly suggestion. I have been too long and too intimately associated with scores of such trustees not to know that they are almost without exception generous, self-sacrificing, giving of their time and money and thoughtful care without stint, and often sacrificing personal convenience and comfort for the good of the college or hospital which they so faithfully serve. Anxious to discharge their trust to the best of their ability, I am sure they will accept these suggestions, the fruit of forty years of personal service as a teacher and a hospital surgeon, in the same friendly spirit in which they are offered.

There are two such classes of institutions to be considered: (1) Medical Colleges and (2) Hospitals, whether they be connected with medical schools or not.

There is, it is true, a third class of trustees for a wholly new kind of medical institution which has arisen as a modern Minerva Medica, born full-armed for the fray. Of this class we have as yet but a single example—the Rockefeller Institute for Medical Research. Akin to it are laboratories for special investigations, such as the two Cancer Laboratories in Buffalo and Boston. But the Rockefeller Institute is so recent, and its scope at present necessarily so undetermined, that I would not venture to consider the duties or these trustees, and I am sure their responsibilities are adequately felt by them. Moreover, their admirable selection of a director for the institution is the best pledge of a future wise administration. I heartily congratulate the profession and America upon the establishment of so peculiarly useful an institute. Its founder has wisely left its work unhampered saving as to its general purpose, and the whole world, and especially the United States, will soon be his debtor for researches and discoveries that will abridge or even abolish some diseases, shorten sickness, prolong life, and add enormously to the sum of human happiness. Could any man of wealth by any possible gift win for himself a higher reward or a happier recollection when he faces the future world?

Though not a medical institution, I cannot refrain also at this point from expressing not only for myself, but for you, our hearty appreciation of what the Carnegie Institution has done for medicine in the re-establishment of the "Index Medicus." This publication is essentially and peculiarly American in origin, but its usefulness is world-wide. It aids alike an author in Japan, or in India, in Europe or America. It is one of the best and wisest undertakings of this lusty educational giant. But to ensure the permanent publication of the "Index Medicus" the profession must show that it really values this generous gift. Unless the "Index" finds a hearty support in the profession abroad and especially at home, we can hardly expect the continuance of this unique and invaluable publication. May I earnestly ask, therefore, of this audience of the chief medical authors of the United States that each one will demonstrate his appreciation by an immediate subscription to the "Index Medicus."

There are some matters common both to the medical college and the hospital which may be considered together. The most important of all these is the cordial and hearty co-operation of the medical men connected with the college or hospital and the boards of trustees. In order to ensure this the members of each body must be acquainted with each other. I have known of instances in which, if a professor in the medical school ventured to suggest any changes as to its management, or even to state his opinion as to the qualifications of a candidate for a vacant professorship, his suggestions were resented as an interference, instead of being welcomed as a means of valuable information. I take it for granted that we should not offer such suggestions after the fashion of a partisan either of a man or a measure, for the advancement of a friend or to the disadvantage of an enemy, but solely for the good of the institution with which we are connected. He who would endeavor to foist a friend upon an institution *because* he is his friend, and in spite of the fact that a rival is the abler man, and better fitted for the position, is just as false to his duty, to his college, or to his hospital as the trustee who would vote for the less desirable man on the ground of personal friendship or of association in some society, church, or other similar body. Of all these influences, that arising from membership in the same religious body is, I fear, the most frequent and yet most absolutely indefensible. What one's theological opinions are has no more to do with his qualifications for a professional or hospital appointment than his opinions on protection as against free trade, or whether Bacon or Shakespeare wrote Hamlet.

I have always honored one of a board of trustees, who was an old personal friend of my father's and who had known me from boyhood, yet who in my early professional career, when I asked for his vote for an important hospital appointment, had the manly courage to tell me that he thought a rival, who was older and more experienced, was the better man for the place and that he should, accordingly, vote for him, and not for me. I confess it was at the time a bitter disappointment to me, but I never had so high an opinion of my father's friend as after he denied me his vote.

There should be, in my opinion, but two questions asked in considering the election of either a professor or a hospital physician or surgeon. First, which one of the candidates for the place has the best qualifications from the medical point of view? This should include not only his scientific knowledge, but his ability practically to impart or to apply that knowledge. Secondly, are his personal qualifications and character such as to make him a desirable incumbent of the position? It must be remembered that a man may be scientifically and practically an extremely able man, but of such a quarrelsome disposition, or the unfortunate possessor of some other similar personal disqualification, as to make him a most undesirable member of a staff. The personal equation may be quite as important as the scientific qualification. Of course, his personal moral character should be above reproach. To place a drunkard or a libertine in a position of so much responsibility and influence is to abuse a trust. No patient should be confined to the care of such a man, and still more no such man should be made an instructor of young men, upon whom his influence would be most disastrous.

It is often extremely difficult for a layman to reach a correct conclusion as to the qualifications of medical men for college or hospital appointments, because of the confident, yet conflicting, statements of their friends. But there is apt to be a certain clear partisanship in such statements which betrays the purpose of the speaker. Especially will this be so if he advocates the election of A or B on the lower grounds of friendship, social position, or for other similar motives. The man who is advocating the best man because he *is* the best man has the stamp of sincerity upon every word.

Perhaps the most striking example I can adduce of such an unfortunate misjudgment is Dr. S. Weir Mitchell, who was denied a professorship in both the medical institutions of his native city, thus depriving them of the most brilliant medical genius that America has produced within my personal recollection. For him it is now a matter of indifference, and for American literature it has been a gain. But for medicine, and especially for physiology, it was an immense loss. Both of his rivals were estimable, worthy gentlemen who held an honorable position in the profession, it is true, but Mitchell is a genius. "Eclipse was first; the rest were nowhere."

One of the best methods of bringing the medical board and the board of trustees into more intimate contact would be to have the dean or a committee of the faculty, or, in a hospital, if the staff is not too large, the whole staff invited to the meetings of the board. Here I can speak from personal experience. At the Orthopædic Hospital and Infirmary for Nervous Diseases in Philadelphia there are three surgeons and three physicians. These members of the medical staff are invited to meet with the board of managers at each monthly meeting, excepting the annual meeting, when the medical staff is elected. They are free to express their opinions on any topic relating to the management of the hospital to which their judgment may contribute something of value, but when a decision is taken they have no vote. It is purely in an advisory capacity and for the purpose of giving and receiving information that they are present. The plan works exceedingly well. When economy is necessary in the hospital, the staff is fully acquainted with the fact and can co-operate with the trustees; when expenses have run up from carelessness in the wasteful use of dressings or appliances, a halt is called; when, alas, very rarely, the treasurer is all smiles, and plans for the extension of the hospital, or the installation of some new addition to the plant is contemplated, their knowledge as to the necessity, for instance, of a hydrotherapeutic or an *x*-ray plant, or a new operating-room, is of the greatest possible value. Nothing but good, in my opinion, can come from such personal co-operation.

One of the difficult questions which boards of trustees have to face is whether there shall be a fixed age at which a college professor or a hospital physician or surgeon shall retire from the active duties of his post. I firmly believe that they should fix such a retiring age in the interest of the students and the patients. As age advances, a man's opinions and his practice become "as petrified as his arteries." He is incapable of constant study, of adding to his knowledge or of keeping up with the feverish strides of medicine. He ought then to be relieved of his cares and his duties. If no rule exists, he is allowed to continue his inefficient or even disastrous work, or by some harsh suggestion is compelled to give place to another more competent man. A rule is a condition accepted when he is appointed. In the army and navy, when an officer reaches 64 or 62 years of age he is retired on reduced pay, and because it is a rule he does not feel hurt or humiliated. So in a college or a hospital, when time and the rule bring us to the period when we must gracefully retire, no one's reputation is injured or his feelings lacerated.

I have ascertained that the following rules are in force in some of the larger institutions:

At Harvard, the age when a professor may request to be retired is 60, provided he has been in the service of the university for 20 years, with a reduced pay ranging from one-third to two-thirds of his salary. At 66 he may be retired by the President and Fellows partly or wholly. The details of the plan are admirably arranged.

At Chicago, while no plan is yet in force, largely, I presume, because of its recent establishment on the present basis, such a plan will soon be made operative.

At Columbia the retiring age, after 15 years of service, is 65, either at the request of the professor or upon motion of the trustees, and on half-pay.

At Yale the retiring age is 65, after 25 years of service, and on half-pay, but the retirement is not compulsory. It will probably be made compulsory before long.

At Cornell the retiring age is 70, but the Pension Fund will not be available until 1914. The retiring pension will then be $1500.

At the University of Pennsylvania and at Johns Hopkins no retiring age is fixed.

The only hospitals I know of in which a retiring age is fixed are the Massachusetts General Hospital and the Boston City Hospital. At the former the compulsory retiring age of the surgeons is 63, and of the physicians, 65. At the Boston City Hospital the visiting surgeons are retired at 65, but the physicians, gynæcologists, and all the other medical officers continue in service indefinitely—a very curious anomaly.

These varying, but in the main identical, provisions, when any exist, show the trend of thought and practice. They generally apply to the medical department, except that, in case a professor is engaged in the practice of his profession and so has a private income, the provision for continuing a portion of his salary does not apply. This is right and fair. Of course, in all hospitals in which there are no salaries, no provision as to reduced salary would obtain.

The point I wish to emphasize is, however, that the age limit (which in my opinion should be 65) should be *compulsory* and so not be invidious in any given case. It will be objected that not a few men are in full intellectual and physical vigor at 65, and it will be a detriment to the institution to lose their services when their ripe experience and admirable teaching are most desirable. I admit it. But for every one such case of harm done by compelling a competent man to stop, there are a score of instances of men who are doing vast injury by their inefficiency. Moreover, in the very few cases in which it might be allowable, as boards of trustees make rules they can unmake them, and in special cases they could pay a graceful compliment and preserve to the institution their exceptional men by extending the limit to 70. In no case should I think it wise to go beyond this limit.

In some of the universities I have quoted a sabbatical year of rest or study is allowed a professor. He is put upon half-pay, and his place is filled by a temporary substitute, who receives the other half of his salary. I believe that in present conditions this should not be applied to medical faculties, for nearly all of the professors are in active practice and take sufficiently long summer holidays. These latter are often spent in observation and study abroad—a most useful and remunerative employment of a holiday—and serve the purpose of the sabbatical year for men whose entire time is given to their teaching. In hospitals it certainly should not apply.

One of the recurring questions in hospital and college management is whether there should be a certain number of doctors on the board. I know that there is a wide diversity of opinion upon this point. My own belief is that a small proportion of well-chosen medical men is a distinct advantage in such boards of trustees. I have said a "small proportion," for it should not be, I think, larger than probably 20 per cent.; and I also said "well chosen"; that is, they should be men of large mental caliber and executive ability. It should be distinctly understood, if not indeed absolutely expressed, in institutions in large cities at least, that any physician or surgeon placed upon such a board should never be eligible, even by resignation from the board, for a position on the faculty or the medical staff. In small towns the lack of suitable persons for hospital trustees and members of the hospital staff might make it desirable not to institute such a rule.

Moreover, such medical men should be selected for trustees as by their mental training, social relations, and personal character would be, so far as it is possible for human nature to realize such a position, absolutely free from influences arising from personal jealousy or professional bias. If it were a social club, it would be perfectly proper to vote against a man because he is personally distasteful, but where it is a scientific body responsible for the education of large numbers of young men and for the care of still larger numbers of hospital patients among the poor, even if a candidate were personally unfriendly I should vote for his election if he were the man best fitted for the place.

Turning now to the duties and responsibilities peculiar to trustees of hospitals, let me point out the objects of a hospital: First, the care and cure of the sick and injured; secondly, the education of medical men and medical students; and, thirdly, the promotion of knowledge, which, in turn, will inure all over the world to the more speedy and certain cure of the sick and injured, and so be of the greatest benefit to humanity.

In order to accomplish these three purposes, it is necessary that the hospital shall have sufficient funds to purchase ground, erect buildings and provide a thorough material equipment. It is a great pleasure to me, as to you also, to note that throughout the length and breadth of the land the medical and surgical staff never tax the always inadequate resources of hospitals for any remuneration. They serve without pay, they give their time and skill ungrudgingly and freely, day and night, to the poor, often for many years, without ever a thought of any money reward. Their reward comes from increased knowledge and skill, and the daily blessing invoked of heaven, often lisped in children's prayers or breathed in mothers' benisons which pass not unheeded by the Recording Angel.

But, as I have pointed out elsewhere, instead of receiving any pay, they give to hospitals. The mere money value of this daily gift of the profession to the poor amounts to an enormous sum. The value of the professional services of the staff of the Jefferson Medical College Hospital, a single hospital in a single city, on a moderate basis of fees, I found was more than half a million dollars annually. The millions upon millions of money given in that most self-sacrificing form—personal service—by the entire profession all over the United States, and I might add with still further pride, all over the world, is simply incalculable. The Gideon Grays and Weellum MacLures are not found only in Scotland or at the countryside. They are even more plentiful in the slums of our great cities, giving of their time, their skill, and—what is more—their hearts, their lives, themselves, to the service of humanity.

Trustees sometimes seem to take it for granted that their duties are ended when they have done two things: begged or given and safely invested the necessary funds, and then elected the staff. To my mind, their duties do not by any means end at this point. They should see to it that the resources of the hospital are utilized to the utmost in doing the largest good.

Let us see now how the objects of a hospital, as I have stated them, can be realized. The first object is the care and cure of the patients. But the cure of any individual patient is not the "be all and the end all" of a hospital. His cure must be a means of larger vision to the doctor, who will thus be better fitted to care for future similar cases. Even his death, if he cannot be cured, should minister to the increasing knowledge and skill of the doctor so that he may be able to snatch future victory from present defeat.

The second—the training of doctors and students—is frequently carried out, but sometimes even objected to. There are three classes of doctors who are trained by a hospital: First, the staff of the hospital itself. I have lived through the period of the establishment of hospitals in many of the smaller cities and towns, and in some cases even villages in this country, for it was a rare thing in my early professional life for any except the larger cities to have hospitals. The moment that a hospital is established with its medical and surgical staff, that moment a new era has dawned on the *community* in which the hospital is established. More careful methods are introduced, greater cleanliness is observed, hygienic conditions are bettered, laboratory methods are inevitably introduced in time. Even if the old-timers, who graduated years before our modern laboratory methods were adopted, do not care for them or cannot use them, the young fellows who come fresh from our medical schools and serve as residents, and even the nurses graduated from our training schools, finally shame the older ones into better ways and greater exactness, not only in the hospital, but in their private work as well.

As a consequence of the establishment of these hospitals and the added skill and training of the local physicians and surgeons, the character of the consultations of the physicians and surgeons of our great medical centers has been greatly modified. The really simple cases, such as hydrocele and small tumors (and even large ones), clubfoot, harelip, etc., which used to be sent to city consultants, are now successfully operated on by the local surgeons, and only the more difficult, serious, or complicated cases are sent to the cities. This is a great advantage to the patient, whose good is the first consideration, and to the local medical men; and, though seemingly a serious loss to the city consultant, it is in the end an advantage, as he must prove his better mettle in the higher scientific fields and be, as well as seem to be, a better man.

Moreover, the trustees of every hospital should see to it that a good library and laboratory are provided. Insensibly the staff will read more and more. A single restless progressive spirit, even though it be a young interne, calling attention to this case and to that, in one journal or another, will compel the rest of the staff to read in spite of themselves. It is absolutely clear that a laboratory with modern equipment for bacteriological, pathological, and chemical research in its examination of tumors, the urine, the sputum, the fæces, the blood, the pus, and other fluids from wounds, etc., is a necessity in every hospital. Even many of our smaller hospitals are equipped with microscope and reagents, if not with a complete bacteriological outfit, which nowadays is inexpensive and imperative. All of this raises the intellectual and professional standard of the staff. I venture to say that no town of 20,000 people can afford to be without its hospital for the sake of its *own citizens,* utterly irrespective of the good it does to the poor who are treated in its wards. It must be established in the interest of the *well-to-do citizens* and their families, so that they may secure better equipped doctors for themselves as well as for the patients in their hospital. Self-interest, therefore, should compel every community to establish its hospital, even if charitable motives had no influence.

Again, the trustees of all hospitals of any size should establish a training-school for nurses. Only those who, like myself, have lived in the period before such training schools were established can appreciate the vast improvement effected in a hospital by this change. To replace the former ignorant, untrained attendants by "trained nurses whose jaunty caps and pretty uniforms and often winsome faces almost make one half wish to be sick, and when one is sick, half loath to be well," is not only a boon to the patients, but to the doctors as well. The intelligent, well-trained nurse, who is on the alert to observe every important change of symptoms and who will keep accurate bedside notes, is the doctor's right hand. Not a few patients who would otherwise lose heart and hope are, one may say, lured back to health and happiness by the tactful attentions and restful, but efficient, care of such a nurse. The community of the well-to-do also are benefited, because the hospital provides them with skilled nurses in their homes when they are so unfortunate as to be compelled to remain there instead of going to the hospital.

The old repugnance to entering a hospital when sick or when an operation is demanded is rapidly fading away. The immense advantages of a good hospital over the most luxurious home are now acknowledged on all hands. The poorest patient in a hospital is better cared for, his case more carefully investigated by bacteriological, chemical, and clinical methods in a hospital, than are the well-to-do in their own homes. Indeed, wise surgeons, except in cases of emergency, now very properly refuse to do operations in homes instead of in hospitals. In many instances lives that would be lost in homes are saved in hospitals, where the many and complex modern appliances for every surgical emergency are provided.

The hospital in direct or indirect connection with medical schools, however, do a far larger work than merely the training of its own staff of doctors. They train three other classes of doctors: First, the undergraduates who are aspiring to the degree; secondly, graduate physicians who spend a certain amount of time in the hospitals either as internes or as temporary students refurbishing their professional knowledge; and thirdly, experts in certain branches of medicine and surgery.

The undergraduates are taught first in the general clinics, where to some extent they learn both by didactic instruction and by seeing the patients, hearing their histories, and witnessing the institution of proper treatment by prescription, by regimen, or, if necessary, by surgical operation. This is of great value, particularly in the more important cases, and especially, for I speak now as a surgeon, in important operations. It is often objected that students see nothing in large clinics. To some extent this holds good; but no student can look on at an operation when the jugular vein or the lateral sinus is torn, the pleural cavity opened, the bowel lacerated, or other of the great emergencies of surgery occur, and fail to be impressed by the coolness of the operator, the carefully explained methods adopted for remedying the mischief, and the various devices used to save life, all of which hereafter will be used by him when similar emergencies may occur.

Yet far more important than the public clinics are the smaller clinics held with classes of ten to twenty men each, when under an experienced teacher the absolute work of the clinic is divided among the various students in turn, watching the pulse and the respiration, giving an anæsthetic, assisting actively at operations, percussing the chest, palpating the abdomen, determining inequalities of the surface or the varying density of underlying organs. Here is the real forum in which our modern medical student acquires his skill. In many cases visits in the ward itself are made, and to a small group around the bedside the physician or surgeon will point out the phenomena to be recorded, the need for the examination of the blood, the results of bacteriological cultures, the facts discovered by the microscope, or the chemical reagent. By the Socratic method, also, he will reveal to the student the imperfection of his knowledge, call out—e-ducate—his powers of observation, of reasoning; stimulate his thought, and give him an impetus which will last throughout life. Who that has "walked the hospitals" with a Skoda, a Trousseau, a Nélaton, a Da Costa, or a Mitchell can ever forget their teaching?

It is sometimes objected by those who are not familiar with the actual facts, and especially by trustees, that this method of actual bedside instruction does harm to the sick. I speak after an experience of nearly forty years as a surgeon to a half dozen hospitals and can confidently say that I have never known a *single patient* injured or his chances of recovery lessened by such teaching. Of course, the surgeon or physician uses common sense. He would not allow a number of men to palpate the abdomen of a patient with peritonitis, or move an acutely inflamed joint, nor would the physician allow a patient with pneumonia to have the chest unduly exposed, or a typhoid fever patient disturbed if his condition were such that it would be inadvisable. But such cases are the exception. In fact, many of you are familiar with patients who have responded to repeated percussion by members of such a class by prompt recovery, attributed by the patient to the supposed medication of percussion.

Moreover, it is by this actual practice only that the student acquires the necessary skill in the use of modern instruments of precision, such as the stethoscope, the laryngoscope, the æsthesiometer, the sphygmomanometer, the various specula. Here he learns when to make blood-counts, how to take histories, arrive at the actual facts by skillful cross-questioning, note the varying symptoms and physical signs of a case, determine the need for laboratory investigations, all under the guidance of skilled observers, who will point out his errors, encourage his queries, and stimulate his thought.

Moreover, trustees may overlook one important advantage of a teaching hospital. Who will be least slovenly and careless in his duties: he who prescribes in the solitude of the sick chamber, and operates with two or three assistants only, or he whose every movement is eagerly watched by hundreds of eyes, alert to detect every false step, the omission of an important clinical laboratory investigation, the neglect of the careful examination of the back as well as the front of the chest, the failure to detect any important physical sign or symptom? Who will be most certain to keep up with the progress of medical science: he who works alone with no one to discover his ignorance, or he who is surrounded by a lot of bright young fellows who have read the last "Lancet" or the newest "Annals of Surgery" and can trip him up if he is not abreast of the times? I always feel at the Jefferson Hospital as if I were on the run with a pack of lively dogs at my heels. I cannot afford to have the youngsters familiar with operations, means of investigations, or newer methods of treatment of which I am ignorant. I must perforce study, read, catalogue, and remember, or give place to others who will. Students are the best whip and spur I know.

Of the value of training graduates in post-graduate work I need scarcely speak,—to this audience at least. The doctor who graduated five, ten, or fifteen years ago comes to our great centers of medical education and renews his youth at the fountain of knowledge. He learns the use of all the new instruments, sees new methods of operation, new methods of treatment, new means of diagnosis, and goes home an enormously better equipped man.

The trustees should see that the staff does not become fossilized by following the same ancient local methods from year to year, but should encourage them to visit other hospitals, see other men operate, hear other men discourse on the latest methods of investigation, and then import into their own hospitals all the good found elsewhere. I learn a deal by such frequent visits to the clinics of my brother-surgeons, and if one who has grown gray in the service can thus learn, surely the younger men can do so. When we are too old to learn, we are too old to remain on a hospital staff.

I do not know anything which has more impressed upon me the enormously rapid progress which surgery is making than a recent experience. I was absent from this country for almost a year and a half. In that time circumstances were such that I saw almost no medical journals and but few doctors. I have been home now eight months and even with incessant work I have not yet caught up, so rapid has been the progress of surgery in this short time. Had I been absent for five years, verily I should have been a "back number," and never could have caught up at all.

In his very excellent presidential address before the Association of American Physicians in 1901, Professor Welch made a plea for hospitals to afford "the requisite opportunities to young men who aim at the higher careers in clinical medicine and surgery." He called attention to the fact that in our bacteriological, pathological, and anatomical laboratories the opportunities, though still too few, were reasonably good, and in a few places exceptionally good, for the training of young men for positions as teachers of anatomy, pathology and bacteriology. Any young man in these departments who by good hard work makes for himself a name is fairly sure, before long, of being called to some important post as a professor, director of a laboratory, or some similar position. But the facilities for work in clinical medicine and clinical surgery are far more restricted, since opportunities for both the exercise of their clinical skill are less frequently open to them and the possibility of combined physiological, pathological, bacteriological, and anatomical research along with their clinical work are but scantily provided for. This plea is reinforced by a recent paper of Sir Michael Foster.* These special graduates, bright young men, determined to devote themselves to one or another department of medicine or surgery, are the men who bring honor to the school at which they obtain their training, and are invaluable to the community. They are future Jenners, Pasteurs, Virchows, Listers, Da Costas, and Grosses, and our hospitals should provide exceptional facilities for these exceptional men.

The third object of a hospital is the promotion of knowledge, and so, fourthly, the good of humanity. Physicians and surgeons engaged only in private practice do not generally keep notes of their cases, and rarely publish important contributions to knowledge. I find in 100 books taken consecutively in my library that 85 were written by hospital men and only 15 by authors not connected with any hospital so far as was indicated on the title page.

In order that proper investigations may go on, trustees should enforce a permanent record of all the cases treated in the hospital, properly indexed, from which the staff may derive their data for papers and books. Each large hospital should have its pathological resident as well as the clinical residents in the various wards, so that post-mortem records shall be well kept, pathological, bacteriological, and chemical investigations of various secretions or blood-counts, etc.,

* Nineteenth Century, January, 1901, p. 57.

shall be properly made and permanently recorded in such a manner—best by a modern card-catalogue—as to be accessible.

It is too often the case that trustees, as I have said, regard their duties and responsibilities at an end when they have taken care of the funds and elected the staff. They may say that, after all, this is their real duty, and that all I have advocated is medical and surgical, and that the responsibility for it should devolve on the staff, and not on the trustees. I do not take so narrow a view of the duties of trustees. When they have elected a physician or surgeon, if he neglects his duty, it is their business to displace him and fill his place with another man who will attend to his duty, and the duties that I have indicated pertaining to the increase of knowledge as well as of its diffusion are quite as much within their province as it is to see that the funds are invested to the best advantage. The intellectual funds as well as the invested funds must bring in good dividends.

If trustees and staff work together for such a purpose and in such a manner, they will create an ideal hospital which will do more good to the patients than any other type of hospital. It will attract the best physicians and surgeons in every community, will acquire the best reputation, not only local, but it well may be national, and do the most for the good of science and the benefit of humanity.

It may be said that this is an unduly strenuous view of the duties of trustees, that in our father's day and in our own earlier lives no such conditions existed or were contemplated. "I need hardly ask a body like this," said President Roosevelt in addressing the Methodists assembled in council, "to remember that the greatness of the fathers becomes to the children a shameful thing if they use it only as an excuse for inaction instead of as a spur to effort for noble aims. . . . The instruments with which, and the surroundings in which we work have changed immeasurably from what they were in the days when the rough backwoods preachers ministered to the moral and spiritual needs of the rough backwoods congregations. But, if we are to succeed, the spirit in which we do our work must be the same as the spirit in which they did theirs."

Moreover, we must remember that "the world field into which all nations are coming in free competition by the historical movement to which all narrower policies must sooner or later yield, will be commanded by those races which, in addition to native energy and sagacity, bring the resources of scientific investigation and of thorough education." The international race for the leadership of the world is just as strenuous and intense in medicine as it is in commerce. If we are going to join the race and win the prize, there must be the highest development of American education at the top. The best men must be pushed to the front, and ample opportunities for growth, for investigation, and for original research must be provided. Never has there been so large an opportunity for the man of large ideas, complete education, and indomitable energy and purpose as there is to-day. The world is waiting, looking, longing for him and will cry "Make room" for him when he is found.

In the hands of the trustees of our colleges and hospitals are the money and the opportunity for developing such men. If the right spirit pervades both trustees and medical faculties and hospital staffs, then it will be but a short time before America will lead the world in medicine as well as she now does in commerce.

Will the profession rise to the level of their great opportunity? Yea, verily they will! Never yet have they been wanting when the emergency arose; not only the emergency of labor, but also the emergency of danger.

In Russia the common soldier counts for little. Yet in Vladikavkaz (where the Dariel Pass—the old Portæ Caspiæ of Herodotus—leading from the Caucasus joins the railroad from Baku on the Caspian to Moscow) is a monument to a common soldier. At the last battle in which the Russians won the victory over Schamyl which gave them undisputed sway over the Caucasus, this soldier blew up a mine and won the day at the cost of his own life. It was ordered that his name should never be erased from the list of his company. At every roll-call when his name is reached, the solemn answer is given, "Died in the service of his country."

In our hospitals lurk the deadly breath of diphtheria, the fatal virus of bubonic plague, of cholera, of yellow fever, of typhoid fever, and the ever-present danger of blood-poisoning. I have known of brother-physicians who have died victims to each one of these scourges. Yet who has ever known one of our guild to shrink when danger smote him on the right hand and the left and death barred the way? As brave as the Russian soldier, ready to risk life, and, if need be, to lose it, these martyrs to duty shall never have their names stricken off the honor list, and at the last roll-call the solemn reply shall be, "Died in the service of humanity."

THE QUALITIES ESSENTIAL TO SUCCESS IN MEDICINE.*

IN the "Selected Essays and Addresses" of that most distinguished English surgeon, the late Sir James Paget, one of the most interesting is entitled "What Becomes of Medical Students." It opens thus: "It is said that, on entering the anatomical theatre for one of his Introductory Lectures, Mr. Abernethy looked around at the crowd of pupils and exclaimed, as if with painful doubt, 'God help you all! What will become of you?'" Sir James then proceeds to analyze the results of an inquiry into the later history of 1000 of his former students. The result may be stated in round numbers as follows: Sixty per cent. achieved success varying from "distinguished" and "considerable" to "fair," 18 per cent. a "very limited success" or entire failure, and 22 per cent. either died or left the profession. His paper concludes as follows: "Nothing appears more certain than that the personal character, the very nature, the will, of each student had far greater force in determining his career than any helps or hindrances whatever. All my recollections would lead me to tell that every student may draw from his daily life a very likely forecast of his life in practice, for it will depend upon himself a hundredfold more than on circumstances. The time and the place, the work to be done and its responsibilities will change; but the man will be the same, except in so far as he may change himself."

* The Commencement Address before the Medical Department of Columbian University, Washington, D. C., June 1, 1903. Reprinted from the Philadelphia Medical Journal, June 6, 1903.

I have had neither the time nor the opportunity to make a similar investigation, but what I shall say is based upon an experience now covering forty years of teaching, during which time I have observed the careers more or less accurately of from 6000 to 7000 students. Their successes and their failures have been probably about in the same proportion as Sir James Paget's. But I have never known a man to fail of achieving an honorable or even enviable success who had four characteristics:

First, a good moral character;

Second, good manners;

Third, perseverance; and,

Fourth, studiousness.

I need say but a word as to a good moral character, for it is the foundation of success in every department of life. He who lacks moral character lacks everything, and not only as a rule will not succeed, but ought not to succeed.

"Manners make the man," is an old adage, and in no calling in life, perhaps, are they so important as in medicine, for the doctor has to do not only with his fellow-men, but very largely with women and children, in which relations good manners are essential. It has been said of a well-known New York physician, now dead, that he owed much of his success to what was humorously called, among his friends, his "ten-thousand-dollar smile," and, while such a statement always carries the inaccuracy which inheres in most aphorisms, yet there was a large basis of truth for it. Neatness always pays. To wear a grease-spotted coat is reckless extravagance. It will cost you far more than a whole, clean, new suit. To display grimy finger-nails is as bad socially as it is surgically.

To illustrate the value of perseverance, my third requisite for success, let me give you an incident which occurred a number of years ago in my own office. Among my students was one who had had unusual advantages. His parents had sufficient means to give him the best education. He graduated at his university at the head of his class. When he took his degree in medicine, he was an honor man. He served an honorable apprenticeship as a hospital resident. He spent a year or more abroad and acquired an excellent knowledge of French and German as well as added to his knowledge in medicine. Before going abroad he married and, as soon as he returned, settled in practice. One day he came to me greatly discouraged and said: "I think I must give up the practice of medicine. My parents have been very kind to me, but I cannot always be dependent upon them for the support of myself and my family." I said to him: "My dear doctor, exactly how long have you been in practice?" "Seven months." "How much have you actually collected in cash?" "Two dollars and a half." In other words, in 210 days he had made 250 cents, a little over one cent a day. It was enough, I confess, to chill even a stout heart, but I encouraged him and told him what I am telling you, that I had never known a man with these four qualifications to fail; that he had three of our four requisites, a good moral character, good manners, studiousness; and that, if he would but remember the fourth qualification, perseverance, he would be sure of success. To-day he is widely known as a most successful practitioner and has an enviable place not only in the esteem of the profession, but in that of the community.

I might give you beside this a little of my own experience, for I passed through almost the identical stage of discouragement that I have just related to you. Failure I thought again and again stared me in the face. It seemed for a number of very long years as if I should never be able even to earn a decent livelihood. Plenty of people needed surgical advice, but the ninety and nine went decorously on the well-beaten paths leading to other offices. Only the one poor forlorn and wandering sheep, attracted by the luxuriant grass in an unfrequented path, reached my own. But I had good friends who encouraged me, and I remembered the story of the knight whose crest was a man at the foot of a great mountain which he was attacking with a pick axe, and whose motto was "*petit à petit*,"—"little by little." More than one disappointment in preferment came to me, but I simply buckled down to my work with more tenacity of purpose than ever before, resolved to do each day the work of that day as well as I knew how to do it. Finally the clouds broke away, and the bright blue sky and the beaming sun were revealed. So it will be with you if you will heed the lesson that I am giving you. Remember Emerson's saying, "Make yourself necessary to the world, and mankind will give you bread."

Studiousness is the fourth essential condition of medical success. Medicine is a science, and one which has progressed with extraordinarily rapid strides, especially within the last few decades. The rate of progress in the next fifty years, during your active lifetime, will probably be even more rapid than it has been. Unless you devote yourself, therefore, to your patients, your books, and your medical journals, you must expect, and you ought to expect, to be left behind, stranded on the shore of idleness, while others sail on to fortune and to fame.

When you begin, for a number of years your cases will be sufficiently infrequent for you to be able to study each case as if your own as well as your patient's life depended upon your knowing all about that case. One case thoroughly studied, so that you know not only all about that individual case, but all about that individual disease or accident, is worth a dozen treated in a slipshod routine manner. If with each differing case you master the disease as well as treat the case, it will not be long before you will have run the gamut of most of the ordinary diseases and have become master of them all. Make each patient understand, while you are investigating his case, that he is the only patient in the world for you at that time. If you practise in the country, do not waste your time in gossip at the corner store. Remember that medicine is a jealous mistress and will allow no rival. She must have your whole heart or she will have none of you.

Moreover, remember that there are broader and larger questions to be studied than this or that disorder, however important it may be. Let me name a few which have arisen in my day. I have seen the birth and development of antisepsis, of asepsis, of all our knowledge of immunity, of the serum treatment of disease, of the *x*-rays, of practically the entire departments of neurology and gynæcology; the whole of pathology and of surgery have been rewritten from the time of Virchow's "Cellular Pathology," published just as I was entering upon the study of medicine, and since Lister's epoch-making work in the sixties and the seventies. These subjects touch all diseases rather than any one disease or any one particular case. In the future there will be new discoveries quite as important, and, it may be, even more so, and you must be on the alert to absorb all the new knowledge that comes from investigations, many of which doubtless you yourselves will be among the foremost to undertake.

In addition to this, you must not neglect that culture which so broadens a man's view, adds to his influence and importance in the community, and is in itself a source of so much delight. Not many of you, perhaps, will be able to imitate the Scotch country doctor whose story is told by John Brown in his charming "Spare Hours." When paying him an early visit, he found the old Aberdonian at breakfast ready for his morning ride, but meantime "amusing himself" (mark you, not *working* at it, but "amusing" himself) "with penciling down a translation of an ode of Horace into Greek verse." But you can all make yourselves familiar, certainly, with the masterpieces of English prose and verse. And let me add that none of you will be as good a doctor as you ought to be unless you know at least French and German and draw not only on the medical stores of knowledge to be found in these languages, but also on the splendid literature which awaits you when you once possess the ability to read and, I hope, to speak these tongues.

When you have gathered sufficient experience and attained sufficient knowledge, write; but not till you have something worth saying. In order to have something worth saying you must have an accumulated lot of case-notes; hence from the very day of your graduation let every case be recorded and indexed. Even the commonest disorders, when you have gathered the notes of a large number of cases, will afford you material for excellent papers which those who are less industrious and less painstaking will read with pleasure and profit.

You are about to join a great and noble profession whose value to the community is beyond estimate. The lives and happiness of the community you serve will be in your hands. Dare you be recreant to your trust, indifferent as to whether you add to your knowledge as the science progresses, or remain a fossil of the year 1903, indifferent to the death of defenseless youth and hoary age, of the bread-winning father, of the tender, care-taking mother, of the loving and beloved child whose untimely death leaves a scar on the heart, which all the waters of Lethe cannot efface?

The whole world has been moved within the last few weeks by an atrocious massacre in Kischineff, and the press and the platform have been right in their denunciation of such a crime. The slain and the injured, it is said, number nearly 1000. But where has a voice been raised in indignant protest against the massacre of 50,000 persons in the year 1902, in the United States alone, by typhoid fever?—a preventable disease which ought to be stamped out, and practically could be stamped out, were a proper water-supply and proper sanitary precautions taken. Have you heard any national denunciation of the massacre last year of 150,000 persons in the United States by tuberculosis?—another disease which, if not absolutely preventable, could be reduced to a minimum by proper sanitation. Our ears have been deaf, our eyes closed, and our minds dulled to this horrible state of affairs, because forsooth we are used to it. How often in my clinic at the Jefferson Hospital, as my house surgeon reads to the class the history of patient after patient, I hear this startling statement: "A. B., aged 25 years, had the *usual diseases of childhood*"—as if disease ought to be "usual." Moreover, those of whom this is said have recovered from the "usual diseases of childhood," but those who have fallen in the holocaust from measles, mumps, chicken-pox, whooping cough, scarlet fever, and diphtheria have passed beyond any clinic or any history. This field alone is a splendid opportunity for fruitful work in this fair twentieth century just opening, and if you do your duty, and the rest of our profession do theirs, long before its end, such a history will state that "A. B., aged 25 years, had the *usual health of childhood*," for the now usual diseases will be banished. Happy childhood will be free from their assaults, and health instead of sickness will be the standard. It is a mark of a low grade of civilization that any disease should be "usual." It reminds us of the days before Jenner, when almost everybody had small-pox, and its victims were numbered by the hundreds of thousands. Soon may the happy day come when the only two causes of death will be accident and old age; when the surgeons will only be called upon to remedy the injuries inflicted by the first, and the physicians' only service will be to assist at our entrance into the world and to sign the death-certificates of centenarians!

THE CHEERFULNESS OF DEATH.*

MOST people, even most Christian people, shrink from Death. In sermons and hymns, and in literature, it is generally represented as repulsive. It is spoken of as "Death's Cold Stream," "The Last Enemy," and the "Dark Valley of the Shadow of Death," and the "terrors of death" are pictured in vivid terms. For the Christian at least this is all wrong. Death should be in reality his best friend; welcomed rather than feared.

So far as the physical aspect of death is concerned, the universal teaching of physicians is that the process of dying is rarely painful or even unwelcome to the patient, though full of sorrow to his family. A happy unconsciousness in nearly all cases shields the dying man from pain. The weakness, the fever, the parched lips, the labored breathing, are all unfelt. Most people die quietly and often almost imperceptibly.

> "We thought her dying when she slept,
> And sleeping when she died"

is often true. Even when convulsive moments occur, they are entirely independent of consciousness; merely physical in origin and character, and absolutely unattended by any suffering.

If, then, death is not an unpleasant process physically, why should it be feared from the spiritual side? See what it does for the Christian.

* Reprinted from the Outlook of October 24, 1903.

It frees him from accident, sickness, and suffering, to which his body has been liable all his life, and from which he has often suffered, sometimes intensely and for long periods of time.

It frees him from all sorrow. No one who has reached even adolescence escapes sorrow. To many, sorrows are multiplied manifold and bear down even the stoutest heart. The "weary" and the "heavy laden" make up the mass of mankind.

It opens the gates of heaven to him. While we know nothing accurately of the details of the heavenly life, we do know that there we shall live in eternal bliss; there we shall be in the presence of God himself; there we shall see and know intimately our Lord Jesus Christ; there we shall feel the influence of the Holy Spirit; there we shall meet the saints of all ages; there we shall be reunited to the dear ones who have happily preceded us; there shall come in due time the dear ones we have left on earth; there our minds will expand beyond our present comprehension; there all the unsolved problems of earth will be as clear as day; there we shall learn why perplexity, disappointment, and trouble were our lot on earth and were needful for the orderly and sufficient development of our own character, and of God's large plans not only for us, but for the race; there, in a world, all that is evil shall vanish away and all that is good shall be ours forever.

If death, then, is not a painful, unpleasant process, and if it does for us so much, it should be, not the last *enemy*, but our best *friend;* not dreaded as the messenger of evil, but welcomed as a companion who will lead us into paths of pleasantness and reveal to us the joys for which we have been longing all our lives. We shall not speak of the terrors of death, but should feel in our very hearts the cheerfulness of death.

THE NEED FOR INCREASED ENDOWMENTS FOR MEDICAL INSTRUCTION.*

TO URGE "The Need for Increased Endowments for Medical Instruction" is entirely superfluous before this audience. It consists of a large number of doctors who know only too well the need for endowment for their own and for every other medical school in this country. I can only repeat, therefore, in part what I have said elsewhere,† adding somewhat to it, perhaps, in the hope that you will repeat it to others, your patients and friends, whom you may persuade to give liberally. It is for the purpose, therefore, of concentrating your thoughts for a few moments upon the question of the urgent need of such endowments that I ask you to listen to me.

I base the need of endowment of medical schools by the general public upon three grounds:

First. The costliness of modern medical instruction.—If you look at any large medical school of the present day you will find a very different state of affairs from what we had when I began the study of medicine. Then we had two lecture-rooms between which we swung like a pendulum, seven men who talked to us in one great mass for an hour at a time for two years on precisely the same subjects—and that was all. To-day you need a large medical building, you need a large hospital, you need a dozen laboratories each with a costly equipment and with a large number of assistants. You need, as President Eliot has so well pointed out, *individual in-*

* An address at the complimentary dinner tendered to Dr. D. B. St. John Roosa, in New York, March 1, 1904.

† Presidential Address before the American Medical Association, p. 295.

struction; not simply lectures to a large class without illustrations and without laboratory work; but small classes of ten, fifteen, or, at the most, of twenty, and individual instruction in the laboratory for every man. When I began the study of medicine in 1860 at the Jefferson Medical College there was no hospital, and from the faculty down to the janitor the number of those who took part in instruction numbered less than a score. To-day in the Jefferson College and Hospital, and its dozen laboratories, we have over *eleven score* of instructors, an increase of over eleven hundred per cent., observe! And these men must be paid, and the men in the theoretical branches, who have not the means of making additional income by practice, must be paid large salaries so that they will be able to give their whole time to the medical school. Yet the fees paid by the students have been less than doubled,—that is, *increased less than one hundred per cent. against an increase of eleven hundred per cent. in the teaching force!*

The medical fees are practically as large as we can make them. The expense, therefore, of modern medical education must be borne largely by endowment. Just exactly as in the academic department of our universities we need great endowments to eke out the insufficient incomes derived from the fees of students, so in our medical schools we need large endowments for the same purpose. Compare, for instance, the theological schools of this country with about 8000 students, in which the average endowment for each student is $2250, with the medical schools attended by 24,000 medical students with costly laboratories, hospitals, and appliances that theology does not require, and a paltry endowment of $83 per student!

The *second* reason for generous medical endowments from the public is *the commercial value of the medical profession to the public.* I am not speaking now of the value of health to everybody, or of our cherished desire for the health of those who are dear to us at home. I am not speaking of the kind father that may be lost to a young dependent family, of the loving mother that cares for them, of the dear child whose place can never be filled in our hearts or homes—I am speaking, mind you, of the mere sordid *commercial value of the profession to the community,* that is, its value to the community in hard cash—dollars and cents. Let me refer to this somewhat in detail.

It is only a few years since quarantine was one of the most horrible things we could imagine. To-day, practically, quarantine has been almost abolished by reason of the researches and work of the medical profession. We no longer fear cholera, the plague, or yellow fever, or even typhoid fever, as we once did, because we have exterminated the rat, we can quarantine or kill the mosquito, we have corralled the fly, and we are filtering and boiling our drinking water. By the most patient scientific laboratory work all these things have been shown to be needful and efficient as the chief means for the prevention of disease.

But a few years ago a single case of cholera or yellow fever down yonder Bay would have meant the loss of millions of dollars to your merchants; but to-day, as has been shown in your hospitals, cases of cholera, or yellow fever, or even of plague, that might and do occur, scarcely create a ripple of excitement because the community knows that your able medical men have these diseases by the throat. Dr. Reed and his fellow-workers in Cuba have accomplished an epoch-making work. For the first time in *one hundred and seventy years* Cuba has been *made* free and *kept* free from yellow fever, and the merchants of New Orleans, of Mobile, of Norfolk, and of New York are reaping the benefit of this unselfish labor in hard dollars on the credit side of their accounts.

The horrible character of the plague we scarcely appreciate. In the fourteenth century twenty-five millions of human beings lost their lives in Europe alone, and even to-day among the ignorant people of India over two hundred thousand human beings a year are offered upon the altar of the plague. But we are beginning to see a brighter time. Haffkine's inoculations have diminished the susceptibility of the people by seventy-five per cent. and have diminished the mortality in equal proportions; and I believe that the time is coming when the plague, like yellow fever and small-pox, will be practically wiped out.

Again, we do not appreciate what small-pox was in the past. In the eighteenth century sixty millions of people died from small-pox in Europe alone, and in addition to that almost all the living were left with the ravages of the disease marked upon their persons. Before that memorable day when Jenner inoculated young Phipps, it was as uncommon in the streets of London to see a person *not* pock-marked, as it is to-day to walk down Broadway and see one who *is* pock-marked. In Russia alone, in the year of Jenner's splendid accomplishment (1796), two millions of people died from small-pox.

I said a moment ago that I would consider only the sordid commercial value of the labors of the profession to the public. Consider, therefore, what all these millions of saved lives mean in revenue to the State, in revenue to the family, in the prevention of pauperism, in the comfort of human beings: then we begin to appreciate in some degree the value of the services practically of one man, the most magnificent benefactor of the human race that ever lived, Edward Jenner.

In 1890 there were 156,638 unnecessary deaths in our large cities because of defective sanitation. For the ten years from 1886 to 1895 the average death-rate in New York was 25.18. The sanitary reform which followed that year saved in 1895, 3758 lives: in 1896, 7736; and in 1897, 9920—a total of 21,414 in three years. As there are an average of twenty-eight cases of sickness for every death, sanitary reform in these three years prevented about 600,000 cases of sickness. And who were the chief of the reformers? You physicians. The millions, nay hundreds of millions, thus saved in the last fifty years in this city alone would enrich even the most avaricious of nations.

I need not tell an audience of doctors what has been done in diphtheria, but I may well refer to its results so that you may in turn remind others. It has been done in our day; and it has been done not as a result simply of constant and fruitless trials of various supposed means of cure; it is not simply the work of a shrewd doctor carefully observing symptoms and noting the effect of remedies: but it has been done by exact laboratory work by quiet men who have been working far away from the sick-room with not a single human patient under their care, men who are not practitioners of medicine, but pathologists and bacteriologists, experimenting on rabbits, guinea-pigs, and mice instead of on men and women, and especially dear little children: and thus working unobserved, unheralded, unseen, they have given to the human race a boon second almost to that of Jenner.

As was shown by the report of the Pædiatric Society not long ago, the mortality of diphtheria has fallen from 40 to 8.8 per cent. In the laryngeal cases, before the introduction of the serum treatment, the mortality was 73 per cent. and the recoveries 27 per cent. Since that time precisely the reverse has been the case; the mortality is now 27 per cent. and the recovery rate 73 per cent.!

And yet there are actually people who reject vaccination and try to prove that the serum treatment of diphtheria is of no use!

In the little town of Plymouth, Pennsylvania, a town of 8000 people, a few years ago on its outskirts occurred one case of typhoid fever, in winter, with snow on the ground. All the dejecta of that patient were thrown out upon the snow. When the warm springtime came and the rain fell, it washed the poison from this patient into the reservoir which supplied the town of Plymouth with water. As a result, 1200 cases of typhoid developed—nearly one-sixth of the entire population—and the town was almost desolated. We have had a somewhat similar experience in another Pennsylvania town, at Butler, when the water-supply was contaminated; and you have seen in this State some of the flower of your young men cut off at Ithaca for the same reason. And all of this was preventable!

When the medical profession has shown you what can be done in the way of preventing typhoid fever, I ask you whether it is not of enormous commercial value to the public, to say not one word of its philanthropic value, in the saving of so many valuable lives?

In 1892, an epidemic of cholera broke out in the town of Hamburg; 18,000 people were smitten down with the disease and 7614 died. Lower down on the river Elbe, where the sewage of Hamburg was added to the other impurities of the river, in Altona, a town continuous with Hamburg, there were but 516 cases. Why? Because Altona had a thoroughly efficient filtration plant and Hamburg had not; yet the researches of the medical profession had shown that proper filtration of the water-supply filtered out all the germs of cholera. Which would have been the cheapest plan—to spend a few millions of dollars on a good filtration plant, or to smite its commerce with a blight for months, at a cost many fold that of the filtration plant? You note that I say nothing of human lives and human woes. The grim satire is completed when I add in addition to the immense cost to its commerce Hamburg had to build the filtration plant after all. I need not refer to any other than this one instance of a single disease to establish the value of the work done chiefly by the researches of the medical profession. The engineer, the architect, other professions, the public-spirited citizens who are in control of municipal affairs, deserve large credit, all of them; but, after all, you gentlemen and your *confrères* in the medical profession are the backbone of this humanitarian progress.

Malaria was formerly thought to be the result of the decomposition of vegetable matter, and that it originated in low-lying swampy land. In Italy alone to-day more than half a million acres of land are entirely waste and desolate because of this dread, disabling disease. On the Adriatic Railway it cost the company one million francs per annum to take care of their sick, due to malaria; but now, thanks to the investigations of medical men, we know perfectly well that if you shut out the mosquito you shut out malaria as well as yellow fever. The warning will be heeded by this country when we dig the Panama Canal. Then, I have no doubt, you will see a splendid object lesson in sanitation, which will carry conviction to us all of the money value of medical research in the saving to the country, to you and to me, of millions of dollars and of thousands of lives.

Of tuberculosis I need scarcely speak, for we all, alas, know its ravages in our homes and hearts. We are on the verge of an equally beneficent improvement in its treatment. In Germany the cure of even ten per cent. of its victims, it is estimated, on a moderate money value of the daily labor of those who recover, will add two millions of dollars annually to the resources of the State. Are not such money results a generous percentage of income from a moderate endowment? And human lives and human happiness cannot be reckoned in dollars and cents.

In military hygiene and sanitation the money return is equally promising. In the British fleet in the West Indies in 1726—I am stealing from a recent address of one of your New York doctors, you see—out of a force of 4750, 4000 died as a result of bad sanitation. On the West African cost the mortality was 69 per cent. During our own Civil War 20 per cent. of the armies were sick. But in spite of all the outcry that there was,—partly just and partly unjust,—during the Spanish-American War, the sick percentage was $3\frac{1}{2}$ instead of 20 per cent. and the mortality was $2\frac{1}{2}$ per cent. Even in distant—and as I suppose some would call it—barbarous Manila the mortality was but $\frac{8}{10}$ of 1 per cent. But you may say these were soldiers and sailors wasting the country's substance and not adding to it; to which I reply that for every soldier or sailor who died an artisan or a farmer had to be taken from productive labor to fill his place; every soldier or sailor saved meant that another productive unit was saved to his family and to the State, and a family which threatened to become a charge upon the community was saved from expensive pauperism.

In fact, at the present day we have changed the aspect with which we look at medicine. Doctors thus far have been, and always will be to some extent, for the care of the sick; but to-day the medical profession is for the *care of the well*—to *prevent* sickness instead of curing it. I glory in it that ours is the only profession on the face of God's earth, I believe, that is trying to destroy itself.

As I am a surgeon, I have purposely preferred to take my examples from medicine, hygiene, and sanitation, rather than from surgery. But I cannot refrain in passing from calling to your minds also a few of the triumphs of surgery. The dreamless sleep of ether cannot be estimated in current coin of the realm, but what would you offer for its blessed relief were it just beyond your reach? But antiseptic surgery has a definite money value, when the mortality of compound fractures—one of the most frequent accidents, especially among our laboring population—which formerly swept into the grave sixty out of every one hundred of its victims and so often left their families destitute, is now shown to be less than five per cent.; when legs and arms formerly cut off to save life are now saved and their owners restored to the ranks of the breadwinners; when rupture which killed so many and disabled so many more is now cured with almost no mortality; when diseased conditions wholly beyond the skill of our fathers are now remedied and their victims returned to active life. Translate these facts into figures and tell me then the money value of surgery alone to the American people! One Jenner, one Koch, one Lister, is worth a fabulous sum to the world.*

I should also refer to the commercial value of all the medical work done in animal diseases, such as trichina, which touches man as well as animals, hog cholera, chicken cholera, rinderpest, and all the other local diseases that affect our cattle. Our failure to control and eradicate hoof and mouth disease in cattle cost a single steamship line lately, in its trade to Great Britain alone, $5000 a day profit—and they say "money talks." The researches and improvements introduced by our profession have reduced the losses to the community by millions of dollars every year, because of the prevention of those diseases. But when a man does not lose his cattle, when the loss is only prevented, he is apt scarcely to appreciate what has been done for him negatively.

I think one of the most remarkable things we have observed in our day has been that experimental railway near Berlin, where on an electrical trolley line they have driven the cars up to a speed of 130 miles an hour. Dr. Pritchett has given a most interesting account of it in a recent article in "McClure's Magazine." It seems that the idea began in a Stu-

* As though to reinforce what I have here stated, the newspapers on April 11th called attention to the fact that Dr. Daniel Lewis, the Health Commissioner of the State of New York, in his Annual Report to the Governor said:

"If the monetary value of a human life is assumed to be $5000, the deaths from only five of the preventable diseases during 1903 in this State represents a loss of $94,960,000. These figures seem appalling and yet millions upon millions can properly be added to this sum, in loss of wages, expense of the care of the sick, and many other expenses incidental to the management of these epidemic and infectious diseases."

denten-Gesellschaft, a company of *students* who proposed to study minutely and exactly all the obstacles in the way of rapid transit and the means by which each in turn could be overcome. That they have solved the problem where all the rest of the world have failed we know to-day, and Dr. Pritchett well says in that article: "*The research habit once considered so far removed from utilitarian ends, is to-day the greatest financial asset of Germany.*"

Go around the world and you meet in Japan, in China, in India, in Egypt, everywhere, the familiar label, "Made in Germany." Why should it not hereafter be "Made in America?" When we have acquired the "research habit" and make it our best and most valuable "asset," I believe that this label will surely supplant the other. This "research habit" in medicine is of as distinct value as a financial "asset," as it is in engineering or in commerce.

The *third* reason that I suggest for increased endowment in medical schools is the *genuine and lasting pleasure that it gives to the donors*. I alluded but a moment ago to the enormous number of human lives saved to the community by surgery. Let me ask, can there be a greater pleasure to any of your rich patients than to know that he has had the comfort and the pleasure of taking a large part in such a wonderful achievement, a large part in such a superb gift to humanity, a gift far better than any warrior ever gave? Could there be a greater comfort while a man lives, or when he enters the valley of the shadow of death, than to know that his gift to a medical school has done and will always do such untold good?

Most of us work both in hospitals and in colleges. As I look over my own work in the Jefferson Hospital and the Jefferson Medical College, I see in the hospital scores of patients, even hundreds of them every year, who go out happy and in comfort, contented and restored to their families and to wage-earning power, and it is no end of pleasure to me, as it is to you, my colleagues, to remember such cases. But when I look over the faces of the hundreds of young men that I have the pleasure of teaching, when I remember that I can instill into them high ideals, when I can bring to the birth in their lives this "research habit" and the desire to learn, and think that they will go all over the world and cure hundreds more than I can—thousands more than I can —which work is the greater? The curing of my scores of patients, or the teaching of hundreds of young men to go out to cure their scores of thousands and to bring the blessings of many an exultant wife and many a poor widow upon their heads for the work that they have learned to do through you and through me?

The joy of the teacher, gentlemen, as you know so well, is a joy that is never ending. It is one of those delights that come to us new every morning and fresh every evening, and yields a sense of satisfaction beyond anything else in this world. And if the rich men of this country will only endow our medical schools and so teach through us all of these hundreds of young men that go the world over as heralds of cheer and apostles of health, surely they will enjoy the greatest satisfaction that can be given to any man.

And when we lay us down for the last time upon our pillow, we can all thank God that we have been able to contribute, some by our work, others by their means, to this magnificent gift to humanity.

AGE AND YOUTH IN MEDICINE.*

I KNOW nothing more inspiring than a scene like the present. Before me is a company of young women and young men, recruits in the medical army, anxious to press forward to all the dangers, trials, failures, and successes of a medical life to final victory. My career will soon end while yours is just beginning. I look toward the western setting sun, you greet the eastern rising sun. Mine is the past with its splendid accomplishments, its dismal failures, its disheartening, unaccomplished tasks. Yours is the golden future, yours to renew the attack where we have failed and to win the battles that we have lost, yours to fulfill our unaccomplished tasks. Naturally, therefore, the occasion suggests a contrast between myself and yourselves. Accordingly, I have taken as my topic "Age and Youth in Medicine."

Let me recount briefly some of the wonderful things that I have seen accomplished in the more than three-score years covered by my own life and then glance at what may be in store for you.

First, the geographical and political changes I have seen have been almost kaleidoscopic in their variety and extent.

The map of Europe has been re-made. Since 1859, the year that I graduated from the University, Italy has been re-created as a united kingdom. This new political life has been followed by a wonderful intellectual revival, so that Italian medical science and letters to-day have won an enviable place.

* Address at the Commencement of the Medical Department of Cornell University, June 8, 1904. Reprinted from the Medical Record, July 30, 1904.

Austria has lost her Italian possessions and has been deposed from her Teutonic hegemony. Germany has been created by the welding of two-score states into one imposing Imperial power. Spain, one of Lord Salisbury's "dying nations," has lost her colonies and her prestige. France has been shorn of Alsace and Lorraine. The Danubian Principalities have taken the first steps toward freedom from the rule of the "unspeakable Turk," the one foul blot still existing on the map of Europe.

The map of Africa has been drawn anew since my boyhood. The "*terra incognita*" which well described central Africa when I first studied geography, has been explored, and Stanley, its foremost explorer, lies in a new-made grave. The sources of the Nile have been found; the Mountains of the Moon have disappeared. Egypt has been renovated by Anglo-Saxon genius. The boundless resources of tropical Africa have aroused the earth-hunger of European nations until nearly the whole of it has been parcelled out among them. A railroad will shortly connect Cairo and the Cape, and modern steamers will soon ply upon every great river of the Dark Continent.

The old map of Asia has been torn in pieces by Russia. Step by step, stealthily, yet steadily, she has encroached upon the various predatory nations of Asia and has made herself master of one after another until it seemed as though everything north of the Himalayas would fall into her capacious maw. But the new map of Asia is now in the making, and in its reconstruction, Japan, thank God, will have much to say; Japan, that wonderful country, which only emerged from feudal seclusion as I was just approaching middle life and then entered upon the most remarkable career of national development ever witnessed in historic time.

And what shall I say of America? True, its boundaries had been enlarged a century ago, but it was still only a vast virgin wilderness, over which roamed the bison, the bear, the Indian, and a few adventurous trappers. In my young manhood

Indian wars were of more than annual occurrence, and practically the whole of our little army occupied frontier forts, which now are centers of a busy civilization. The "prairie schooner," slowly creeping across the plains, faintly presaged the Pacific railroads; Chicago was Fort Dearborn when I was born; St. Paul was a village and Minneapolis was a name yet uncoined even when I graduated from Brown University; Texas, California, and Alaska were all added in my early years, and even you have seen Hawaii, Porto Rico, and the Philippines become possessions of the Great American Republic.

In the arts and sciences that minister to the progress and comfort of man, the changes have been equally rapid and widespread. The railroad and the steamboat were just at the beginning of their marvellous development when I was born. No human face had yet been fixed by the complaisant sun on the plate of the daguerreotype, the ambrotype, or the photograph. The scythe has been replaced by mowing and reaping machines; typesetting and printing were done by hand instead of typesetting machines and the swift Hoe printing press. In my childhood days the ragpicker was a familiar figure on the streets, hooking over the piles of waste to find the linen rags from which paper was made, and paper, therefore, was very costly. Now, our forests are ground into paper and the modern penny newspaper has been born. I shall never forget my father's incredulity when he first read of a machine which would do the work of a woman's deft fingers, but the American sewing machine has conquered the world.

In my boyhood electricity was scarcely known outside of the laboratory. Its marvellous multitudinous uses, to-day barely at the beginning of their development, were utterly unknown. The first commercial telegraphic message was sent in the very year of my birth—now it is one of the daily needs of millions. Its omnipresent wires have scaled mountains, burrowed under the slime of the sea, girdled the earth, and put Puck to shame as a lagging messenger. Even in late years the telephone, the trolley, the dynamo, the electric lamp, and wireless telegraphy have all sprung into being as by magic, and soon all of our rivers will be harnessed and made subservient to the comfort of mankind.

The human hand, that most perfect instrument, has been almost driven out of the industrial market by various machines which do its work so much more cheaply and often so much better. Metallurgical processes have so cheapened the production of iron, copper, aluminum, and other metals that whereas a few years ago their constant use was impossible on account of their cost, they are now common household implements.

When I was in college, the so-called Fraunhofer lines were simply a curious phenomenon in the solar spectrum; yet, a few years later, they furnished us with a chemical analysis not only of the sun, but of far distant comets and nebulæ, and have determined even the velocity of light coming from the furthest confines of the universe. Nay, more, by means of the spectroscope elements unknown on the earth have been discovered in the sun; and now that by its means we have discovered helium and know that uranium becomes changed into radium and radium into helium, one element into another, the asserted philosopher's stone of Paracelsus and the other alchemists, by which they could transform the baser metals into gold, may possibly be found to be of more substantial stuff than dreams are made of.

Meanwhile educational endowments of millions have been made. Philanthropy cares for the children, the prisoner, the degenerate, and the lower animals; slavery has been abolished; the International Tribunal of Arbitration will soon be housed in a palace dedicated to Peace and erected by an American; and religious liberty is enjoyed as never before.

But, with all this wonderful progress, where has medicine been? Has it kept step with the other arts and sciences or has it lagged behind? It delights me to say that it has not only kept up with the foremost rank, but has even outstripped not a few. In 1846 and 1847 ether and chloroform were discovered and the operating-table was robbed of well-nigh all its terrors. Thirty years later, thanks to Lister, antisepsis added its benison to the blessing of anæsthesia, and operations have been deprived of nearly all their pain and of their former frightful mortality. These two blessings, the one making operations painless, the other making recovery almost certain, have made possible a new surgery which was not only impossible, but even undreamed of, when I began to study medicine. In this way have been developed the surgery of the kidney, of the liver, of the gall-bladder, of the pancreas, of the stomach, of the intestines, of the appendix, of the prostate, of the brain, of hernia, of the pelvic organs, and even of the heart. By these means the mortality of compound fractures and of ovariotomy, which used to claim two out of every three patients, is now reduced almost to a vanishing point. In fact, were my old teachers of surgery, Gross and Pancoast, to come to life, they could not even understand our modern vocabulary; and if they were to visit a modern surgical clinic, they would think us stark mad.

Moreover, we have blocked many diseases at the fountain-head by discovering their causes and the means by which they become diffused among the well. Thus we have found that the guilty culprit spreading yellow fever and malaria is the mosquito, and that the cause of malaria is a parasite whose life-history is now perfectly known. The efficiency of our means for preventing outbreaks of both of these scourges of the human race will find a splendid illustration within the next few years in the sanitation of the Isthmus of Panama, which will be Chapter II in the splendid volume whose first chapter was written in Cuba by Major Walter Reed of the United States Army. The cause of the plague and its dissemination by the rat is well known; the cause of typhoid fever and its dissemination by flies and through drinking water, and of cholera and its diffusion through drinking water, are also matters of popular knowledge. We know now the deadly cause of diphtheria, and the use of its antitoxine is making the once loud wail of parents for their lost little ones, as after the death of the first-born in Egypt, grow fainter and fainter. The prevention of small-pox has been known for a century, and lately its probable cause has been found by an Italian and by an American. The cause of cancer, of scarlet fever, of measles, and of many other of the commoner diseases of childhood, have as yet eluded the scrutiny of the ablest men of the profession. The discovery of these is among the unfulfilled tasks to which I referred a few moments ago, which is committed to your hands.

Microscopical analysis and the chemistry of the secretions have been wholly rewritten within the past quarter of a century, while the examination of the blood as a means of diagnosis and the serum treatment of disease have made splendid beginnings. Percussion and auscultation have opened a new world to us in the diagnosis of diseases of the chest and abdomen.

Meantime numerous instruments have been added to our armamentarium, without which the modern physician and surgeon would be almost helpless. The thermometer, which has only been our hand-maid for about thirty years, has substituted exactness for surmise; the hypodermatic syringe disclosed a new method of medication about the same time; the aspirator was not known till after I graduated in medicine; the ophthalmoscope has revealed an unknown world in the interior of the eye, and with many other instruments of precision, has made ophthalmology one of the most exact of the medical sciences and a model of accurate measurement and statement for all its sister sciences. The otoscope, rhinoscope, cystoscope, œsophagoscope, and other similar instruments have revealed to us the interior of other organs of the body in a way formerly wholly unknown, while the simple hæmostatic forceps and retractors have made many modern operations physically possible.

The growth of medical laboratories within the last twenty-five years has been phenomenal. The laboratory has done much more than merely afford the opportunity for investigations which have yielded such an abundant fruit. It has cultivated laboratory methods—that is to say, methods of exactness, and the use of instruments of precision. The experimental method in medicine has done more than any other one thing to widen the boundaries of our knowledge. Besides this, it has cultivated precision in thinking, which is more important than any instrument or method. The vague theories and subtle reasoning of our forefathers are now replaced by exact methods of investigation. The difference is well set forth by Mumford when writing of Rush and the yellow fever. "Like the rest of the profession," says he, "Rush was at his wits' end, and it is interesting to note how different from modern methods were the means adopted by such men for solving the problem of treatment. In these days the natural history of a disease is worked up, its pathological anatomy investigated, and clinical and laboratory researches elaborately and carefully made in order to learn the exact nature of the phenomena under discussion and so, perchance, to find an appropriate and rational remedy. Those ancient men, on the contrary, had their preconceived notions as to the nature of the disease, and limited themselves mainly to searching the literature of the subject and to experimenting with drugs." Reasoning about the yellow fever and its effects, Rush "thought he saw that the debility indicated by the low pulse was due to the 'oppressed state of the system' [whatever that may mean], which must be relieved by purging, supplemented by bleeding."

Imagine, if you can, the forlorn condition of the doctor sixty years ago without our present means for physical diagnosis, without the thermometer, the hypodermatic syringe, the various specula and other instruments I have named, without the aid of hæmatology, of anæsthetics, of antisepsis, of the modern microscope, without our laboratories, and our experiments, our chemistry, our bacteriology, and our antitoxines—without everything except his eyes, his ears, and his fingers: then you can appreciate the triumphal march of medicine during a single lifetime.

In this brief review I have given you, very hastily and imperfectly, something of what has been done in medicine during my own lifetime. What, now, has the future in store for you?

You entered the medical school in vastly different conditions from those which obtained when I began the often weary study of Gray, Gross, Watson, and Ramsbotham. I am often reminded of the time when the Chief Captain rescued St. Paul from the mob, and asked him whether he were a Roman citizen. When the Apostle declared that he was, "With a great sum obtained I this freedom," said the Chief Captain; to which his Hebrew captive proudly answered, "But I was born free." You, too, are "born free"; born to an inheritance of anæsthesia, of antisepsis, of laboratories, of improved methods of teaching, of many heretofore unknown drugs. "With a great sum" of toil, and work, and worry the men of my generation have obtained the freedom which you have inherited.

What use will you make of this freedom? First, you will improve, I trust, on our present laboratory methods and our present methods of teaching. Pathology, a feeble aid to medicine and surgery when I began my medical studies in 1860, and bacteriology, a word found in no lexicon of that date, have become veritable foundations of the medical curriculum even since I began to teach. You, in your turn must develop other and at present equally unsuspected sources of knowledge. You will introduce new instruments of precision, new means of investigation, and will thus be able to defeat and, still better, to prevent disease. The men who will make the most progress in the next generation will be the physiological physicians and surgeons, those who are best acquainted with chemistry and physics, and who will investigate the blood, the secretions, and the tissues in present ways more perfectly developed, and in new ways of which now we cannot even guess the method or the object. Leukocytosis, iodophilia, cytodiagnosis, cryoscopy, blood-pressure—all these you will use and improve upon far more than I dare picture. Comparative pathology will enrich and broaden your views. Possibly the original suggestion of Sir Christopher Wren, of intravenous medication, which we practice to but a small degree to-day by infusions of salt solution and of adrenalin, may become one of the recognized avenues for the administration of remedies. The ultramicroscopical vision which has just been conferred upon us, by which minute particles far beyond observation with our ordinary microscopes have been made visible, has opened up a new world for investigation which may develop truths as yet unsuspected.

Ten years ago who would have believed that it would be possible to look through skin and flesh, bandages and splints as though they were not, and to see our bones and determine their state of health or disease, of fracture, or integrity; and yet to-day this is known to every layman. Radio-activity, and possibly new means for the employment of light, may open new avenues for treatment. Certain it is that your studies in immunity, in toxines, and antitoxines will give you new weapons by which to prevent or vanquish disease and confer health. We need a new and safe anæsthetic. We need new drugs, new instruments of precision, by which new properties of matter, and novel methods of physical diagnosis shall be discovered, and the beneficence of medicine illustrated by unexpected and, to-day, impossible methods of cure. In these researches, alas, I shall take no part, but I can at least goad you on to their accomplishment.

But I must not forget that I am speaking to American graduates in medicine. When I was a young man, every young graduate who could afford the time and expense went to Europe to put the finishing touches to his medical education. But the current is turning westward, and will enable us ere long to repay the great debt we owe to our European brethren by freely sharing with them our future wealth of scientific and practical knowledge and experience. We have awakened to a new life of research in the laboratories founded by liberal citizens,—and no institution has more reason to be proud of a generous patron than has Cornell,—we have felt a new intellectual impulse in our colleges—our physicians and surgeons are alert and progressive as never before.

Coincident with a great political expansion that has carried us half-way around the globe, with a commercial expansion which has made the world stand amazed at what we have accomplished—if the experience of England under Elizabeth, of Italy under Victor Emmanuel, of Germany under two Kaisers is any guide—there will surely be in America an equal intellectual and scientific expansion. The future belongs to America—it belongs to you—if you but show yourselves worthy of the great inheritance to which you are heirs, and of the splendid possibilities which medicine offers you with lavish hand. You will be unworthy children of worthy sires if you do not rise to the level of these opportunities. Shall it be said that our statesmen, our merchants, and our manufacturers are abler, more enterprising, more conquering than our scientists, our surgeons, and our physicians? Nay, verily. You, new members of our own profession, will assuredly prove yourselves equal to the mighty task set before you, and conquer the world by being its noblest, wisest, and most unselfish benefactors.

SURGICAL REMINISCENCES OF THE CIVIL WAR.*

I HAD the honor of being sworn into the service of the United States as an Assistant Surgeon in the shadow of the Capitol on July 4, 1861, though I had only begun the study of medicine in September, 1860, and did not graduate until March, 1862. It came about in this wise. My preceptor, Dr. John H. Brinton, had received a telegram from a former student (let us call him Smith), who had graduated in March, 1861, and was Assistant Surgeon of the Fifth Massachusetts, saying that he was going to leave the regiment and asking that Dr. Brinton should immediately send some one in his place if possible. Dr. Brinton very kindly offered the place to me. I said to him with very becoming modesty that I hardly felt I knew enough, to which he replied with combined frankness and flattery by saying: "It is perfectly true that you know very little, but, on the other hand, you know a good deal more than Smith." Accordingly I entered the army and immediately went into camp in Alexandria.

From the 4th until the Battle of Bull Run, Sunday, July 21, 1861, fortunately, I had very little to do. The surgeon of the regiment attended to sick call, while I tried to make myself somewhat familiar with military surgery. I remember only too well, however, the trepidation with which I went to attend one member of my regiment who accidentally had shot himself through the chest. If the soldier had known how slender was my own fund of information, his breast would have harbored not only a serious gunshot

* Read before the College of Physicians of Philadelphia, April 5, 1905. Dr. S. Weir Mitchell and Dr. John S. Billings contributed papers on their reminiscences at the same time.

wound, but many disturbing doubts as to the probability of his recovery in the hands of Assistant Surgeon Verdant Green.

My first initiation into real warfare was at the First Bull Run. We had marched the day before until after midnight and were awakened after a brief sleep to the activities of a memorable day in the history of the war. It was an exceedingly hot day, and we marched and halted and marched and halted in the thick dust under a broiling sun until about noon, when my regiment became engaged. Up to that time, and, in fact, during the entire engagement, I never received a single order from either Colonel or other officer, Medical Inspector, the surgeon of my regiment, or any one else. It was like the days when there was no King in Israel, and every man did that which was right in his own eyes. I did not see the surgeon from the middle of the forenoon.

As we approached the battlefield, I saw beside a little stream a few surgeons, among whom I knew one, and I asked him what I ought to do, for I was as green as the grass around me as to my duties on the field.* My friend Carr, of Rhode Island, suggested that I should turn in there and help, advice which I followed all the more readily because just at that time some of the advance of my own regiment appeared among the wounded. After a time, I saw everybody around me packing up and leaving, and upon asking what was the reason, was told that we were ordered back to Sedley Springs Church, a mile or more in the rear. Accordingly I went with them, and there in a grove alongside of the road, with no fence to enclose it, stood the little church perhaps one hundred feet distant from the road.

* Surgeon W. S. King, of the regulars ("Medical and Surgical History of the Rebellion," Part I, Medical Volume, Appendix, p. 2), calls attention to the fact that he and Assistant Surgeon Magruder were, with few exceptions, the only medical officers at the first battle of Bull Run who had ever served with troops in the field.

Both inside and outside the church much was going on. An operating table was improvised from two boards laid on two boxes in front of the pulpit; the slightly injured looked down from the gallery upon the industrious surgeons, and a number of kind women from the neighborhood helped to soothe the wounded.

I always have remembered one little illustration of the ignorance even of brigade surgeons who had been hastily appointed at the outbreak of the war. One of the wounded required an amputation at the shoulder-joint, and the operator asked the brigade surgeon to compress the subclavian artery. This he proceeded to do by vigorous pressure applied *below* the clavicle. With a good deal of hesitation, I at last timidly suggested to him that possibly compression above the clavicle would be more efficacious, when, with withering scorn, he informed me that he was pressing in the right place as was proved by the name of the artery, which was *sub*clavian. I do not remember whether the operator took a hand in this little linguistic discussion or even overheard it. I had my rather grim revenge, happily, not to the serious disadvantage of the patient. When the operator made the internal flap the axillary artery gave one enormous jet of blood, for the subclavian persisted in running where it could be compressed above the clavicle, in spite of its name. I caught the artery in the flap, as I had been taught to do by Dr. Brinton, and instantly controlled the hæmorrhage.

Later, I was outside the church dressing a man who had a fracture of the humerus from a Minié ball. I was applying a splint and an eight-yard bandage. We were in the wood surrounding the church, perhaps twenty feet back from the road, when suddenly one hundred or more of the soldiers rushed pell-mell down the road from the battlefield crying "the rebs are after us!" It did not take more than one positive assertion of this kind to convince the man whose arm I was bandaging that it was time for him to leave, and he broke away from me, rushing for the more distant woods. As he ran, four or five yards of the bandage unwound, and I last saw him disappearing in the distance with this fluttering bobtail bandage flying all abroad.

My experience in this battle is a good illustration of the utter disorganization, or rather want of organization, of our entire army at the beginning of the war. It was wittily expressed in a statement which appeared in "Vanity Fair," the "Puck" or "Life" of 1861. The editor announced that he had received from their correspondent on the field a dispatch which far surpassed that of Cæsar: it stated the location of the battle, described the varying fortunes of the day, and announced the final result. Their correspondent's laconic telegram also "ran:" "Bull Run, They Run, We Run."

Later in the day the Quartermaster of my regiment brought the Colonel, who had been badly injured by a falling limb of a tree cut off by a solid shot. He told me that orders had been issued for the army to retreat to Washington, and I joined them, caring on the way for the Colonel. Soon after the battle the time of my regiment expired and we were mustered out of the service.*

I resumed my studies in September, 1861, graduated in March, 1862, and two months later entered the army by examination. Under a medical officer of the army whom I scarcely saw I was put in charge of the Eckington General Hospital on the outskirts of Washington. Not long after taking charge, one Saturday afternoon about 4 o'clock, I received an order to report at the office of Dr. Letterman, the Medical Director of the Army of the Potomac, in Washington. I had had so little experience in army orders that I almost trembled at the formal and peremptory character

* For my report of the battle see "Medical and Surgical History of the War of the Rebellion," Part I, Medical Volume, Appendix, p. 9.

of the order. I feared that without knowing it I had done something to displease Mr. Stanton, the Secretary of War, who was a good deal of a bogy to most people at that time, for he had a way of putting them sometimes into Fort Delaware or other similar close quarters, without giving any reasons, too, which was very disagreeable.

When I reported to Dr. Letterman, however, I found that very stirring events were about to occur. He directed me to go to the Ascension Episcopal Church and the Eighth Street Methodist Church, which were just around the corner from each other, and prepare them for general hospitals; that I should find the Quartermaster already there making the needful alterations, and that I was to have them ready for occupation within five days. It was then about 5 o'clock on Saturday afternoon. I went to my field of duty and worked nearly all night, resuming my work very early in the morning. A gang of carpenters worked all night. At about 10 o'clock on Sunday morning the minister of the Ascension Church, who was well-known for his secession views, entered the main door, his eyes wide open with astonishment at what was going on both outside and inside of the church. Finally his inquiring gaze fell upon me, and, as I was in uniform, he judged that I could tell him the reason why the last pews were just disappearing under a new board floor. I answered his question by saying that the Secretary of War had taken possession of the churches of Washington and was converting them into hospitals, at which he uttered a "humph," turned on his heel, and I saw him no more. In sharp contrast was the action of the minister of the Methodist Church, who, with every member of his family, spent a large part of every day, and often the entire day, in the hospital ministering to the soldiers.

My assignment to this duty gave me another opportunity of learning how utterly deficient I was in training for my position. People sometimes imagine that a practising physician can be transformed into an army surgeon merely by putting a uniform on him. I was not lacking in ordinary intelligence and was willing to work, but I was utterly without training. To get those two churches ready as hospitals I had to have beds, mattresses, sheets, pillow-cases, chairs, tables, kitchen utensils, knives, forks, spoons, peppers and salts, all sorts of crockery and the other necessities for a diningroom, all the drugs, appliances, and instruments needed for a drug store for two hundred sick and wounded men; I needed orderlies, cooks, and the endless odds and ends of things which go to make up a well-organized hospital. I did not know how to get a single one of these requisites. As to drugs, I did not know whether to order six ounces or a gallon of laudanum, an ounce or two or a pound or two of opium, and I was in utter darkness as to the mode of getting any of the other things from a teaspoon to a cook. However, I inquired and as soon as I learned how, I set myself to work. For two nights I slept only about three hours each, and I had the satisfaction of reporting to Dr. Letterman at the end of three days, instead of five, that I was ready. On the fourth day I had one hundred wounded men in each hospital.

Happily all this is now remedied by the Army Medical School in Washington, which has been so wisely provided for training medical officers not only in post-graduate work in surgery, bacteriology, etc., but in the making out of requisitions, quartermasters' returns, the descriptive list of every patient, and all the endless, but much needed, bookkeeping of a great army. For want of such proper documentary evidence not a few deserving soldiers lack a pension, and for want of it many a scamp has obtained a pension who would never have received it had his record been accurately known. A similar medical school does the same good work for the Navy.

In August, 1862, was fought the Second Bull Run. The campaign was ushered in by Pope's famous order dated "Headquarters in the saddle," which was wittily criticized as placing his headquarters where his hindquarters ought to be.

I was sent out from Washington to Pope's army with a large supply-train. On the way, near Fairfax Courthouse, we met General Phil. Kearney with a squadron of cavalry. He fell in with the enemy within ten minutes after he passed us at a gallop and received a mortal wound. My supply-train was shelled for a short time from a parallel road at some distance to the north of us by a Confederate battery, which seemed to me odd in view of Pope's proclaimed victory. However, I finally reached Centreville and soon afterwards began to distribute the instruments, blankets, medicines, stimulants, etc., I had brought. I had 400 dozen bottles of whiskey, brandy, sherry, etc.; 2600 blankets; 600 cases of soups in cans (one of the few things that were then put up in cans); 800 complete suits of underclothes; a dozen operating cases, etc. Before I left Washington I had been directed to be rather sparing in distributing these, and I obeyed orders; but afterward I had good reason to regret my want of liberality, for on the third day Colonel Fauntleroy, of the Sixth Virginia Confederate Cavalry, marched in and took a hand in the game. He was accompanied by one of the surgeons of Lee's army, whose name, unfortunately, I do not remember: but I have a very vivid recollection when I gave them the key of the little smoke-house in which I had stored the medicines, stimulants, operating cases, and smaller and more valuable things that I had brought along—how their eyes widened and their faces were wreathed in smiles as the doctor, after a rapid survey of the boxes on the walls, turned to the Colonel and said with an expletive, "There is more good whiskey in this little smoke-house than there is in the whole city of Richmond."

The army left, and left me practically stranded. I was not attached, of course, to any regiment, brigade, or headquarters. Again, nobody gave me orders, but, as I found in the little church in Centreville one hundred wounded men who needed attention, I saw my duty well marked out. All of these men were severely wounded, for the slightly wounded marched away with the army. Upon a few mattresses and with almost no other conveniences or comforts, the men were laid in rows on the floor. Most of them had, in fact, not even a mattress, but only a little straw under them, and this in a very little time, when "laudable pus" began to flow, became soiled and had to be diminished daily. The bedsores which followed were something frightful, often larger than an entire hand, and, when we add to all this the secondary hæmorrhages which often soaked the floor before they could be arrested, one can have an idea of the sufferings of these poor fellows, and of the task of those who were caring for them.

Moreover, the food problem soon became a serious one. We had only a very moderate supply of canned soups that the Confederates had very generously given us when their own commissariat was sadly deficient, and we had nobody to forage for us, for all of the able-bodied soldiers had gone away lest they should be taken prisoners. Fortunately two or three of the Christian Commission and the Sanitary Commission were on hand and helped.

The third day after the battle I passed such a night as I had never before experienced in my life. Long trains of ambulances arrived carrying our wounded from the field of battle back to Washington, and there were but four surgeons to look after them and their many imperious needs. Fifty poor, thirsty fellows were crying for water; fifty more were crying with the pain from a jolting ride of nine miles over a corduroy road. Most of them had had nothing to eat for one, two, or three days, save what they had obtained from the haversacks of poor fellows who were dead in their neighborhood. Some had such horrible wounds that they could absolutely go no further and must be got out on stretchers and taken into the hospital.

One of us immediately started with a pail of water and a tin dipper to supply the first want of all; another, as quickly as we could heat some soup, started on a similar errand to supply their hunger, while I took a bottle of morphine and my pocket penknife and did not worry over any superfluous exactitude in doling out the blessed relief which morphine brings to men in pain. All of this was done in total darkness, with two or three dim lanterns, in a drizzling rain, and in six inches of Virginia mud.

Fortunately, just as our food was giving out, an ambulance train was sent from Washington and took our patients and ourselves back to civilized conditions and surgical opportunities.

In September, 1862, I was sent to Frederick, Md., immediately after the battle of Antietam and assigned to Hospital No. 1, in charge of my since then lifelong friend, Dr. Robert F. Weir. One little incident that occurred just after I got there was of a good deal of personal interest to me. After the battle, when the present Mr. Justice Holmes, of the Supreme Court of the United States, then a Captain in the army, was wounded, his father, Dr. Oliver Wendell Holmes, immediately left Boston to find him. The journey is embalmed in a delightful account, published soon afterward in the "Atlantic Monthly" under the title "My Hunt After the Captain,"* though he did not include in his story the following little incident. In 1862 Holmes, of course, was really at the height of his fame. The "Atlantic Monthly" had only been started a few years before, when I was a student in Brown University. In its very first number the publication of the "Autocrat" began, and through this the entire country knew him well. One day at noon, having just

* "Atlantic Monthly," Dec., 1862, p. 738.

finished the round of my ward, I was sitting in the office in undress uniform. The only other person present was the officer of the day, who, of course, was in full uniform. He was a gentleman whose knowledge of English literature was quite limited, and I fear the same criticism could be made upon his knowledge of surgery. The door opened, and with a quick step a dapper little man whom I instantly recognized by his portrait, though I had never seen him before, stepped in, glanced from one to the other, and quickly walked up to the officer of the day. He introduced himself by saying, "My name is Holmes, Dr. Oliver Wendell Holmes, of Boston. I have come in search of my son who is wounded." My colleague looked at him for a moment, scratched his head to gather his fugitive ideas together, and repeated in a half-absent tone, "Holmes, Holmes, seems to me I have heard your name before, sir," at which, in spite of paternal anxiety, the Autocrat's eyes twinkled with amusement.

The surgery of that time was very simple,—cold water dressings or simple cerate spread on lint made by patriotic women by scraping one side of old linen sheets or tablecloths, or, to encourage suppuration (for pus at that time could be "laudable"), the ordinary flaxseed poultice. An amputation stump was always dressed with a Maltese cross of lint spread with cerate. Hanging out of the two ends of the wound were from five to twenty or thirty silk ligatures, one, two, or three of them with one or more knots tied in them in order to identify those ligatures which belonged to the larger vessels. From about the fourth or fifth day traction was made upon each string to see whether the tissues had rotted away sufficiently to allow it to become detached. The knotted ligatures on the large vessels were not touched for a week or ten days, and not uncommonly when they came away, either spontaneously or from traction, a gush of blood would announce a secondary hæmorrhage, requiring reopening of the wound or, in some cases of repeated hæmorrhage, a ligation of the vessel higher up in the limb, or an amputation. Sometimes, as in Lord Nelson's case, these ligatures on large vessels did not come away for many years.

What we did not have in those days was almost more noticeable than what we did have. Among our blessings, however, were ether and chloroform. Ether, it will be remembered, was first used publicly in the Massachusetts General Hospital on October 16, 1846; chloroform was discovered by Sir James Simpson in the following year, 1847. Yet you will be surprised when I tell you that Lord Roberts records, in his "Forty-one Years in India," that in the Sepoy Rebellion of 1857, ten and eleven years after the discovery of chloroform and ether, there were no anæsthetics to alleviate the sufferings of those heroes who were wounded during the terrible siege of Delhi.* We had, however, no antiseptics, for antisepsis was as yet even undreamed of; hence erysipelas, pyæmia, and hospital gangrene were rife. Many a time have I had the following experience—indeed, it was fully expected and looked upon as unavoidable: A poor fellow whose leg or arm I had amputated a few days before would be getting on as well as we then expected; that is to say, he had pain, high fever, was thirsty and restless, but was gradually improving, for he had what we looked on as a favorable symptom,—an abundant discharge of pus from his wound. Suddenly, overnight, I would find that his fever had become markedly greater, his tongue dry, his pain and restlessness increased, sleep had deserted his eyelids, his cheeks were flushed, and on removing the dressings I would find the secretions from the wound almost dried up and what there were were watery, thin, and foul-

* "Anæsthetics and antiseptics were then unknown [!]; consequently few of the severely wounded recovered and scarcely a single amputation case recovered" (Lord Roberts, vol. i, p. 195).

smelling, and what union of the flaps had taken place had melted away. Pyæmia was the verdict and death the usual result within a few days. The total number of cases of pyæmia reported during the war was 2818, of whom 2747 died, a mortality of 97.4 per cent.!

Erysipelas, too, was rampant and it was a common observation that it followed the direction of the wind both in the same ward and in its direction from one ward to another. We had already learned the hard lesson, however, that our erysipelas cases must be isolated and dressed last or an epidemic would occur—why, the best of us could not tell. Hospital gangrene—a disease now banished, I hope, forever—whose very name is a bit of sarcasm, was very common. In the hospitals of Louisville alone and for only a portion of 1862 and 1863, Middleton Goldsmith tabulated 343 cases, with a mortality, happily, of only 21 or 6.2 per cent. The total number of cases of gangrene of all kinds was 2642. In 2503 cases in which the result is known 1361 recovered and 1142 died, a mortality of 45.6 per cent.* It was a phagedænic ulceration which, if we should see it now, we would probably find was due to a streptococcus infection.† Often did I see a simple gunshot wound, scarcely larger than the bullet which made it, become larger and larger until a hand would scarce cover it, and extend from the skin downward into the tissues until one could put half his fist into the sloughing wound. In my report upon Hospital Gangrene,‡ as it occurred in Frederick, Md., and in the West Philadelphia Hospital, I pointed out that repeatedly a few days of cold rainy weather requiring windows and doors to be closed, thus preventing a change in the atmosphere of suppuration,

* "Medical and Surg. History, etc.," Part III, Surgical Volume, p. 824.

† For good illustrations of this practically vanished disease see the colored plates in the Med. and Surg. History of the War, Part II, Surg. Vol., pp. 739 and 928, and Part III, Surg. Vol., p. 53.

‡ Med. and Surg. History, etc., Part III, Surg. Vol., p. 826.

which then was normal, would be followed by an outbreak of hospital gangrene, and a few days of warm sunshine would promptly check its ravages. One case in particular, after Antietam, I remember: A wound on the inside of the upper thigh which enlarged and deepened, first exposing the femoral artery, then eating its way deeper and deeper under the artery until the pulsating vessel stretched like a red rope across the chasm. Beside his bed, day and night, sat an orderly with instructions, in case secondary hæmorrhage occurred, instantly to screw down the pad of a Petit tourniquet placed *in situ*. It was one of the most instructive illustrations I have ever had of the resistance of the fibrous and muscular wall of an artery. After a time the gangrene was arrested, the artery became covered with granulations, the chasm below the artery slowly filled until the granulations reached up to the artery, then gradually rose on each side of it, and finally covered it completely, and the wound cicatrized without the loss of a drop of blood.

Our method of treating hospital gangrene, which was empirical, we now know to have been based on sound pathological grounds. Isolation and fresh air, and locally, pure nitric acid, the acid nitrate of mercury, the actual cautery, or bromine, as was introduced into practice by Middleton Goldsmith, were our only, but efficient, weapons.

Tetanus also claimed its frequent victims: Of 505 cases 451 were fatal, a mortality of 89.3 per cent.

While I was in Frederick, Dr. John H. Brinton began what is now the most splendid Military Museum in the world, that of the Surgeon-General of the Army in Washington. He appointed me his representative in and about Frederick and later in Philadelphia. It was my duty to gather and forward all the specimens that I could lay hands upon.

Among them I remember were more than a score of knee-joints, every one of which with our then surgical resources should have been amputated. Conservative treatment of joints was an impossibility until antisepsis and asepsis made it not only a possibility, but a duty. The popular opinion that the surgeons did a large amount of unnecessary amputating may have been justified in a few cases, but, taking the army as a whole, I have no hesitation in saying that far more lives were lost from refusal to amputate than by amputation.*

Wounds of the abdomen involving the viscera were almost uniformly fatal. If we were absolutely certain that the bowel was penetrated by finding fecal matter exuding through the wound, of course we would then open the abdomen, but he was a bold surgeon in those days who would do an abdominal section without such positive knowledge. Opium was practically our only remedy and death the usual result. Not more than one incontestable example of recovery from a gunshot wound of the stomach and not a single incontestable case of wound of the small intestines are recorded during the entire war among the almost 250,000 wounded. Of recovery after wounds of the large intestine there were 59 cases. When we remember that to-day recovery has followed as many as 19 perforations of the bowel and mesentery, it gives those of us who went through the Civil War many a pang of conscience. Only too sharply do we remember the dreadful things that we did do and the good things that we did not dare to do.

Of 852 amputations at the shoulder-joint, 236 died, a mortality of 28.5 per cent. Of 66 cases of amputation of the hip-joint 55, or 83.3 per cent., died. Of 155 cases of trephining, 60 recovered and 95 died, a mortality of over 61 per cent. Of 374 ligations of the femoral artery, 93 recovered and 281 died, a mortality of over 75 per cent.

* "Conservative surgery was practised too much and the knife not used enough" (Letterman's Med. Recollec. of the Army of the Potomac, p. 49).

These figures afford a striking evidence of the dreadful mortality of military surgery in the days before antisepsis and first-aid packages. Happily such death-rates can never again be seen, at least in civilized warfare.

Among other specimens, one of the most curious which I sent to the Army Medical Museum is a bullet which I found at a post-mortem in a very unique position. It was caught in the omentum, so that when the omentum was held up the ball was suspended in a net ("Med. and Surg. History," etc., Part II, Surg. Vol., p. 174).

The mischief one ball may cause is well shown in a later student and friend. It entered just below the left eye and emerged just behind the lobe of the left ear. (1) A long-standing caries of the bones followed; (2) the left ear was deaf; (3) the left eye was blind; (4) the left facial nerve was destroyed, causing paralysis of the left side of the face; (5) the ball passed through the left temporo-maxillary articulation, and ankylosis of the jaw followed; (6) a surgeon who attempted to remedy this ankylosis broke a number of his good teeth and also by a later operation caused (7) a salivary fistula, requiring (8) another operation for its cure. (9) Repair of his teeth was impossible on account of the ankylosis, and (10) he was compelled to live all his life after his wound on soft diet, being able only to separate his teeth to a very slight extent and not being able to masticate other food. In spite of all of these accumulated troubles he was a most cheerful, useful, and devoted surgeon in the Marine Hospital Service and a well-known expert on yellow fever—the late surgeon Murray.

During the winter after Antietam I was ordered to the (West Philadelphia) Satterlee Hospital. One of the curious memories of a colleague in that hospital was when I quickly arrested his hand just as he was about to fashion the flaps the wrong way, so that the stump would have been whittled down like a lead-pencil, and the flaps have been left on the amputated portion.

Another vivid memory was my experience with secondary hæmorrhage after the battle of Gettysburg. Cases of secondary hæmorrhage began to appear even before the end of the first week, but during the second week they occurred with dreadful frequency. When I was on duty for twenty-four hours an officer of the day and it was my duty to attend to all emergency night calls I had five cases of secondary hæmorrhage in a single night about two weeks after the battle. In the last 20 years I do not remember five other cases—thanks to antiseptic surgery. One of them I particularly remember, a gunshot wound just above the inner end of the right clavicle. The bullet had not emerged; its direction was unknown; the hæmorrhage was profuse,—whether from one of the smaller transverse vessels of the neck, or from the carotid, jugular, subclavian, or even the innominate, was wholly unknown. I etherized the man and proceeded to search for the wounded vessel. My only light was a square block of wood with five auger holes, in each one of which was placed a candle. It was before even the days of petroleum, which had then just been discovered in Pennsylvania. As the wound was so near the mouth, of course the light had to be near the ether cone. I have often wondered why I did not have the sense to use chloroform. Suddenly the ether took fire and the etherizer flung away both cone and bottle. Luckily the bottle did not break, or we might have had an ugly fire in a hospital constructed wholly of wood. I was fortunate enough finally to secure the vessel after much searching and a large loss of blood, and was gratified to discover that it was one of the transverse arteries of the neck. The patient recovered.

This case illustrates well the disadvantages under which we then labored. There were no hæmostatic forceps. In the depths of such a wound the tissues could not be seized and drawn up to the light and the bleeding vessel quickly clamped. Our only resource was to try to pass a tenaculum through the vessel and tie it with silk. Usually we were only successful after several attempts. Meanwhile that vessel and others were all bleeding; the others had to wait their turn. Moreover, we had no retractors by which we could get a good view of the depth of such a wound. We had no hypodermatic syringes at the beginning of the war, and they were not in common use till some years after its conclusion. The mouth and the bowel were the only avenues for the administration of remedies. We had no aspirators and, what will astonish many of my younger hearers, we had no clinical thermometers; our only means of estimating fever was by touch. It was not until several years after the war—say the early seventies—that the thermometer became a common instrument. It was then about from ten to twelve inches long, was never used excepting in the axilla, from which it stuck up like a mast, and was often broken by movements of the patient or pressure of the bedclothes. The first short clinical thermometer, such as we now have, which I ever saw was a gift from my friend Dr. S. Weir Mitchell, brought from London in 1876. Many of my other thermometers have met with casualties and finished their career by sudden catastrophies, but this one, strange to say, has had a charmed life, doubtless due to the distinguished giver, and I still use it with great satisfaction.

In 1863, at the request of Drs. Mitchell and Morehouse, I was ordered to the Christian Street Hospital, in the old police station which still stands on Christian Street below Tenth Street, and later in the Turner's Lane Hospital, which then stood in the midst of a large farm near Twenty-second Street and Columbia Avenue. These two hospitals were successively devoted to the diseases and injuries of the nervous system.

The first nervous case that I remember was a very remarkable one and the first of its kind ever recorded. It occurred while I was Executive Officer at the Satterlee

Hospital, West Philadelphia, a very short time before I was ordered to the Christian Street Hospital. As Executive Officer it was my duty to assign new patients to the wards and also to transfer the cases in the specialties, such as the eye, nervous diseases, and injuries, etc., to the special hospitals. One morning as I sat at my desk a soldier applied for assignment. On looking up at him I said to myself: "You are Dalton's cat." Those of you who are familiar with Dalton's good old text-book of physiology will remember a picture of a cat whose right cervical sympathetic nerve had been severed. The left pupil is very large, the right one very small, and the moment I looked at this man I was struck with the similar condition of his pupils. I quickly asked him: "Where were you wounded?" and when he pointed to his neck I said to myself again: "That ball destroyed the sympathetic nerve." I immediately transferred him to the Christian Street Hospital, and a few days later followed him. His case is reported in full in our little book on "Gunshot Wounds and Other Injuries of Nerves," p. 39. In the autumn of 1864 I took a copy of this book to Claude Bernard in Paris, the discoverer of the function of the cervical sympathetic and the effect of its division upon the pupil and the blood-vessels. He exhibited true Gallic enthusiasm when I showed him the first recorded case in the human subject, which confirmed his brilliant researches, which were the beginning of our knowledge of nature's beautiful automatic regulation of the blood-supply.*

The results of injuries of nerves have been dwelt upon fully by Dr. Mitchell, and I need say little about them. All of our patients, of course, were convalescents. The phenomena of fatal cases we had no opportunity of observing, but I can never forget the extraordinary contractures,

* This was the real starting point of our knowledge of the functions of the sympathetic nerve, although Pourfour du Petit, in 1727, had noticed the effect of its division on the pupil. (de Schweinitz.)

paralyses, and other results of the extensive wounds of nerves such as we studied there for the first time. One poor fellow (since then I have seen one similar case) was shot directly through the posterior portion of both eyeballs; another had necrosis of a large part of the body of the third cervical vertebra. The sequestrum discharged through the mouth, showing the anterior portion of the foramen for the transmission of the vertebral artery, which, fortunately, did not suffer either by the original wound or the secondary necrosis and suppuration.

Very naturally among so many soldiers of diverse character, and especially of men with wounds and injuries of the nervous system, we had perhaps more than our usual proportion of malingerers. In the "American Journal of the Medical Sciences" for October, 1864, p. 367, in a paper on "Malingering," especially in regard to simulation of diseases of the nervous system, a number of our conclusions were stated. From the necessity of the case, we devised some new means for discovering such malingerers. We first suggested the use of ether (alone or in combination with other means) as a test in a number of alleged diseases and conditions in which it had never before been used. It proved a most efficient method of detection. For instance, in asserted blindness, we suggested that the man should be etherized, the *sound* eye then covered with adhesive plaster, and when recovering from the anæsthetic, before he was able to reason and guard himself against making mistakes, that his sight should be tested by very simple means, such as holding out to him in the hand some water or some whiskey, or any other act which would reveal the presence or absence of sight in the supposed blind eye. So in deafness we discovered some malingerers by the old trick of gradually lowering the voice; but hearing, like sight, can best be tested during the recovery stage of ether when the patient is taken unawares, as Parr, in his "Medical Dictionary," speaks of a man who pretended to be dumb, of whom a sympathetic passer-by, with most insidious humanity, inquired: "How long have you been dumb, my good friend?" "Three weeks, sir," replied the uncautious deceiver.

We also recorded what Da Costa first called our attention to: that in feigned lameness the cane is apt to be put down *after* the leg instead of before, whereas a really lame man, needing the support of a cane, always will put the cane down *first.* In some instances the substitution of the urine of a soldier known to have renal disease by a malingerer for his own of course was readily detected by having him pass his water in the presence of the ward-master or of the surgeon.

In both paralysis and ankylosis we again resorted to the use of anæsthesia, a means which now, of course, every one is familiar with, but which at that time was a novelty. Sometimes it was not needed, as accident would disclose the fraud. Thus, one of the most persistent and successful malingerers at last unmasked himself. His right arm had long hung useless by his side. One day as he was going out on leave a high wind suddenly blew the cape of his overcoat over his head, and in an unguarded moment both arms were raised to throw back the cape so that he could see. The Army of the Potomac speedily received a reinforcement of one. A necessary precaution is to be noted,—namely, that sometimes malingerers who had been in the ward a considerable time and had seen other patients etherized, not only feigned disease, but feigned complete anæsthesia long before it actually existed, and thus very nearly deceived us. A little extra dose, so that one is absolutely *sure* that the etherization is real and not imitated, of course, will avoid this danger. In this manner we detected one man whose arm had been "paralyzed" for a long while, and left him yawning and stretching himself with both arms far above his head and every effort to move them down resisted by his deltoid, which, previous to this test, had been entirely useless. The same test served us well in some cases of alleged aphonia. The old adage "*In vino veritas*" might well be applied to anæsthesia. The supposed blind will see, the dumb will speak, the lame will freely move paralyzed limbs, deaf ears will be unstopped, and all in spite of the malingerers' best efforts.

In one of our cases of aphonia, detected without the slightest difficulty, the patient, however, quickly recovered himself and fell at the surgeon's feet with clasped hands, exclaiming with a voice and attitude worthy of a Garrick: "Thank God, Doctor, you have restored my voice!"

Our means of detecting fraudulent epileptics are fully described in the paper above mentioned. For want of time I cannot do more than refer those interested in the subject to it for details.

Three things are impressed upon my mind as a result of this review of the Surgery of the Civil War. The first is the utter inadequacy of our present system of enlargement of the medical corps of the army when war or a great battle suddenly precipitates this necessity upon us. The parsimony of Congress has cut down the numbers of the medical military establishment below what is necessary for a proper performance of its duties even on a peace basis. The Surgeon-General always is forced to employ a large number of acting assistant surgeons, who, faithful as they may be, can ill supply the place of men trained in the regular medical corps. When war suddenly comes, an enormous number of barely competent or often incompetent men must be put in charge of the lives and health of the soldier, men who are as utterly untrained as I have shown I was when I entered the army. The Medical Corps of the army should be enlarged, as was urged upon the last Congress by the President, the Secretary of War, and the Surgeon-General; all vacancies should be filled, and measures taken either under existing or future laws to have a supplementary Medical Corps ready for instant service.

A second reflection is that, subject of course to imperative military requirements, medical officers should have substantial control over sanitary matters, such as camping places, latrines, water supply, &c. These are often vital to the efficiency of an army. Our later experience in the Spanish-American War and by contrast the extraordinary results which have been obtained by the Japanese methods reinforce this suggestion in a most striking way.

The last reflection is that those who made such a fearful outcry as to the sufferings of our soldiers in the Spanish-American War, though justified to some extent, did not know what suffering was as experienced during the Civil War.

When a battle occurs, the survivors of the regiment must march away with the army and some of their surgeons must go with them. When, therefore, tens of thousands of men are wounded in a day or two the number of surgeons available is totally inadequate for the sudden emergency. It is absolutely unavoidable, no matter what progress is made in the scientific treatment of wounds by first-aid packages and other devices, or in methods of transportation, that men, especially those of the defeated army, must often lie on the battlefield one, two, three, or more days before they can possibly be attended to. The horrible suffering this entails is part of the grim penalty of war. Those of us who went through the Civil War are the most anxious to avoid another war. Only a righteous and noble cause can justify such sacrifices and suffering.*

*See an excellent paper by McCaw, Jl. Assoc. Military Surgeons, May, 1905, p. 334.